Railway Mechanical Engineer

Vol. 99 October, 1925 No. 10

Using the Railway Mechanical Engineer

In the September issue we commented upon practical ways in which some of the mechanical department officers are utilizing the *Railway Mechanical Engineer*. Our comments apparently struck a responsive chord, because we have since learned of several officers who are regularly asking at least some of their subordinates to read certain specific articles and advise whether the principles, methods or practices described have been tried, or whether better results can be secured in other ways. One superintendent motive power in particular, asked all of his subordinates, down to and including the foremen, to tell what they thought of the first two prize articles on "The foreman and his responsibility" and the correspondence in the August number relating to "Bill Brown's" first prize article. In the neighborhood of 175 reports were received indicating that his associates had closely read all of these articles and outlining the extent to which they agreed or disagreed with various suggestions which were made. It is difficult to estimate the results of the careful study of these articles on even one railroad by all of those who occupy positions of leadership in the mechanical department. Does anyone question the great importance or value of making use of the *Railway Mechanical Engineer* in this way? Would it be worth while to have some one person on the staff of the mechanical superintendent select those articles of special merit which are of interest to different classes of foremen and officers in the mechanical department and ask for a report on whether the ideas suggested are in use or could be applied to advantage?

Periodical shopping of freight cars

The *Railway Mechanical Engineer* has frequently commented on the lack of systematic methods of bringing in freight cars for general overhauling. Contrary to the practice with respect to locomotives by which a regular cycle of shoppings for classified repairs is established, most generally on a mileage basis, freight cars have been placed in the shop in a haphazard manner with little attention to regularity or the condition requirements for the most economical overall maintenance cost. It is very encouraging, therefore, to find at least one railroad which is giving much the same attention to the advance scheduling of the heavy repairs on its various series of freight cars that locomotives have long received. There are, no doubt, other railroads that are now giving this subject serious attention, but those who read the paper on the subject of the progressive system of freight car repairs presented by F. A. Starr at the convention of the Chief Interchange Car Inspectors' and Car Foremen's Association, which will be found on another page in this issue, will recognize that the Chesapeake & Ohio is doing a notable piece of work in combining the periodical shopping of its cars by series with such production methods in the shops as the segregation of the cars in each series, employment of the progressive system of shop operation, the specialization of shop forces and the scheduling system.

Mr. Starr's paper, since it deals primarily with that subject, places the greatest stress on the progressive system of putting the cars through the shops, and, indeed, it is this system which has made possible the application of the scheduling system, with its reduction of lost motion and waste supervisory effort, to freight car work. To the progressive system must also be credited the development of a regular program of periodical shopping because the fullest advantage of the progressive system could not be taken unless such a program were in force.

Probably the greatest difficulty encountered in any attempt to apply production methods to freight car repairs arises from the difficulty of providing the various shops on any railroad with a regular supply of cars of the same series, all of the same type of construction and the same age and, therefore, all requiring approximately the same type of material and operations in their rehabilitation or reconstruction. It is true that this is a real difficulty if an attempt is made to take the cars out of service without carefully laid plans having been developed well in advance of the beginning of the repair program. It is precisely at this point that the development of a regular program of periodical overhauling of each series of equipment becomes effective. When once established, it provides the basis on which equipment from the various series may be segregated in sufficient numbers to keep the shops regularly supplied. Indeed it may be said that such a program of periodical overhauling must be the foundation of any structure which has for its purpose the most freight car service for the least maintenance cost.

The foreman's qualifications

The article by W. J. Taylor which was submitted in the competition on "The foreman and his responsibility" and which appears elsewhere in this number, goes frankly to some of the roots of the question, approaching it, however, in quite a different way from the three prize articles which have already been published. Those who have followed these articles closely must recognize the fact that the great value of the competition lies not in any one of the articles, or in the first prize article, but in the group of articles as a whole. Moreover, many of the ideas which have been presented in the four articles which have already been published could very well be amplified and enlarged upon. Mr. Taylor, for instance, makes a very pertinent suggestion about stealing the ideas or suggestions made by subordinates or workers. Intimate contact with men in the ranks and many of the foremen and supervisory officers has emphasized the fact that nothing can do more to lower the morale or discourage ambitious

men than a foreman or officer who claims individual credit for good work or suggestions made by men under his charge. Such an attitude effectively discourages that constructive interest on the part of the men which is so necessary and desirable in the interests of the highest degree of efficiency.

Mr. Taylor in his description of an imaginary staff meeting has cleverly and tactfully touched upon one of the difficult situations which confront many of the foremen and subordinate supervisory officers; a situation, by the way, which has been magnified and thrown into the limelight on some roads on which works councils or organized co-operation have been established. It has been a bit embarrassing to many of the foremen who have consistently recommended detail improvements for a number of years, to have these improvements made when the facts were finally brought out in open council by representatives of the workers. If it were not such a serious problem in many shops, also, the fact that machine tools and equipment 30, 40, 50 or 60 years old are being used to repair 1925 equipment, could well be regarded as a joke. Unfortunately it is no laughing matter for those who have the responsibility of securing efficiency and output.

Among the other pertinent suggestions made by Mr. Taylor we cannot overlook the statement that "spoiling of work is generally the result of poor supervision." What would it not mean to the railroads if the full import of this statement could be driven home and profited by? Some of us will never forget that thorough, efficient superintendent of motive power, who has now passed on, who consistently declared that equally good results could be secured from day work, piece work, bonus or other systems, if those in charge understood just how a job should be done and just how much time should be required to do it—and he proved his assertion by conducting a large shop on a day work basis as efficiently and economically as any other railroad shop in the country. There was a minimum of spoiled work and it was because there was a maximum of efficient and intelligent supervision. There are many other things in Mr. Taylor's article that are worthy of comment, but we could not resist the temptation of making some reference to these three things, which in some ways stand out above the others.

Emphasis upon the human element

Sometimes we receive a severe jolt when we set up a measuring stick and see what rapid progress has quietly been made over a comparatively short period along more or less radical lines. There has been much discussion in recent years about personnel departments on railroads. Vice-presidents in charge of personnel have been appointed, or we have noted the quiet inauguration of personnel work under the direction of chief executives, who have added personnel experts to their staffs whose titles might mean anything.

Not a few mechanical department officers rubbed their eyes recently when the New York Railroad Club announced that the address at its September meeting would be made by Edwin F. Daley, assistant to superintendent of motive power and equipment—director of personnel—Delaware, Lackawanna & Western. Mr. Daley had had a thorough experience in the mechanical department work on the railroads, but was taken from one of the industries a year and a half ago to specialize on personnel matters in the mechanical department of the Lackawanna. So quietly and unobtrusively has this work been carried on that only a comparatively few people outside of the Lackawanna knew anything about it, and these were largely men from other roads who were interested in personnel matters.

Many people have assumed that Mr. Daley is the only man who has been specializing on this sort of work entirely within the mechanical department. It is quite probable, however, that if a careful survey were made, similar experts or officers might be found in the mechanical departments on a number of railroads. The name will not be found in the Pocket list of Railway Officials, but among the attendants at the meeting of the New York Railroad Club was David A. Henderson, who for the past two and a half years has been acting as personnel supervisor on the staff of the superintendent motive power of the Long Island. Mr. Henderson came to that road without railway experience, but with considerable training in personnel management in other industries.

Only last June, F. H. Becherer, general car inspector on the Boston & Maine, was made assistant to the mechanical superintendent. No general public announcement was made of the exact duties to be undertaken by Mr. Becherer, but it was understood that he would give all of his time to personnel matters and would be provided with such assistance as might be required. Mr. Becherer, while he was general car inspector, found an opportunity to assist in the promotion of foremen's clubs on the Boston & Maine and has always taken a keen interest in personnel matters, particularly along educational lines.

These developments are surface indications of a great and fairly rapid evolution which has been taking place in the railway field, and particularly in the mechanical departments of our railways. Emphasis today is being placed more and more on the importance of the human element in the organization. This has brought to the very forefront the necessity for the highest type of leadership on the part of the foremen and supervisory officers. It accounts to some extent for the great success of the *Railway Mechanical Engineer* competition on "The foreman and his responsibility." Such a competition announced even five years ago could not have attracted nearly as widespread interest or have inspired so large a number of contributions. It is doubtful, also, if the standard of the prize papers would have been anywhere nearly as high as those received last spring, the fourth of which is published in this number.

Traveling Engineers' Association hitting the ball

A résumé of the proceedings of the thirty-third annual convention of the Traveling Engineers' Association, held at Chicago recently as reported elsewhere in this issue, leads unavoidably to the conclusion that this association has increased the sphere of its influence and activity until now it is a real factor in providing efficient transportation service on steam railroads. In fact, it is "hitting the ball," and, since there is always room for improvement in associations of this kind, it is a pleasure to record that every indication points to an increased activity on the part of members of the Traveling Engineers' Association during the coming year and an even better convention in 1926.

Traveling engineers occupy a strategic position in the railroad transportation machine because of their intimate contact with operation. They are the supervisors most closely in touch with the men who move trains. All the equipment the railroads own can never earn a penny until it moves. It would be difficult to over-estimate the value to each railroad of its able traveling engineers who, by instruction, encouragement and practical example, influence locomotive enginemen and firemen to operate locomotives in either road or switching service more intensively and economically. If the traveling engineers on a single road are important, the influence of the Traveling Engineers' Association, embracing as it does members from practically every railroad in this country as well as

representatives from Canada and Mexico, is proportionately greater. The membership of the association in 1924-25 was 1,486, 252 members being reinstated during the past year and 105 new members added, making a total of 1,843 railroad men at present holding membership in the Traveling Engineers' Association. We do not recall one of the minor mechanical associations which goes into the discussion of reports as thoroughly as do the traveling engineers, and, as long as proper control of the discussion is maintained to keep it pertinent and on the subject, this feature should be encouraged.

The officers of the Traveling Engineers' Association during 1924-25, including the association's veteran secretary, W. O. Thompson, are to be congratulated on the success of the convention just passed. The prospects for an even better convention next year are most promising. The president elect, J. N. Clark, chief fuel supervisor of the Southern Pacific, brings to his office a wide experience in association work of this kind and he has already set a goal of 500 new members for the association in the coming year. There should be no difficulty in reaching this mark if the railroad men who are already members of the association catch a vision of its possibilities, do a little boosting, and go out individually after new members.

Plans for the convention in 1926 are already under way and a simple reading of the following list of subjects on the program without any attempt to analyze each, gives a good indication of what may be expected at the next convention: "The locomotive of today," "Smooth train handling," "Practical instruction for new firemen in combustion and locomotive operation," "The locomotive booster," "Locomotive availability in 100 per cent condition for operation," "How can the traveling engineer cover his growing job?" In addition, it is proposed to schedule the time for each report and its discussion so that members who are unable to attend the entire convention can arrange to be present on the day in which subjects of particular interest to them are to be presented.

All well wishers of the Traveling Engineers' Association will personally interest themselves in the next 12 months in securing new members, invest ungrudgingly a portion of their time in the preparation of committee reports if requested, boost the association to their superiors and make plans as far in advance as necessary for attendance at the convention next year.

New Books

A MANUAL OF LOCOMOTIVE RUNNING SHED MANAGEMENT. *By Walter Paterson, staff department, London, Midland & Scottish Railway, Manchester, England, and Harry Webster, running department, London & North Eastern Railway, Lowestoft. 212 pages, illustrated. 6 in. by 9 in. Price $6.00. Published by Charles Griffin & Company, Limited, London, and J. B. Lippincott Company, Philadelphia.*

The object of this book is to present, in a convenient form, the essential information relative to the efficient management of steam railway locomotive and car shops as conducted in Great Britain. For the mechanical department officer engaged in railroad work in this country, considerable information in this book is of interest, especially the methods recommended for handling locomotive repairs. The authors have intentionally refrained from giving detailed descriptions of shop processes and operations, but have included descriptions of engine-house equipment and practice. It has been written primarily as an introductory manual for the use of junior officers and foremen in charge of departments.

It contains 13 chapters, with 44 illustrations, discussing such subjects as the organization of the staff and functions of its various members, personnel and employee welfare, stores department organization and management, fuel conservation, computation of locomotive mileage, locomotive and coach cleaning, locomotive and car repairs, causes and remedies for engine failures, methods used in handling wrecks, and the utilization of waste material. A number of tables are also given in an appendix in the back of the book showing the approximate temperature of a fire as indicated by its appearance, the approximate temperature of a car journal as indicated by its appearance, the strength of chains, capacity of water tanks, the delivery of injectors in gallons per hour, etc. Descriptions of a number of jigs and tools suitable for engine-house and wrecking service are given in the chapters devoted to locomotive repairs and break-downs.

TESTS FOR RAILWAY MATERIAL AND EQUIPMENT. *By Henry Knauer, 257 pages, illustrated, 4¾ in. by 7½ in. Price $3.00. Published by the Simmons-Boardman Publishing Co., 30 Church Street, New York.*

The material contained in this volume is elementary in its scope and is intended for those taking up testing work in the laboratory and for those in the shops aspiring to engage in inspection of railway materials in the field. The tests are explained in such a clear, concise manner that a novice in this work should experience no trouble in grasping the fundamentals necessary for a successful laboratory analysis. The phraseology is such that all calculations and arithmetical substitutions are readily comprehended without recourse to chemistry or higher mathematics.

The first two chapters are devoted to the explanation of the nature of a test and with the methods and importance of recording the results of the findings. The next two chapters go into a detailed explanation of water and the treatment of the various mineral and organic compounds which may be found in it to cause trouble, particularly in a locomotive boiler. For a necessarily brief treatment, this particular subject is well handled. It is followed by several chapters dealing with all the tests required to determine the quality of paints and varnishes. Various oils and greases are briefly covered. More information on these materials should have been included but the reader can obtain an idea of the fundamental requirements of a good oil and grease. Chapter X contains a list of nine mechanical materials which the author quickly passed over with a few elementary remarks. The various laboratory tests to determine the quality of rubber goods and cement are explained in a very thorough manner. Chapter XIV contains four pages on the subject of cast iron. Considerable more space could have been devoted to this important subject. The chapters on wrought iron and steel products are well done and the chapters dealing with tension, hardness, fuel heat value tests and flue gas analysis are well worth reading for those handling these tests in the laboratory. The chapters dealing with the quality of steam and steam boiler tests and the methods of determining indicated and brake horsepower contain elementary information for novices interested in these tests. The last four chapters touch briefly on the subjects of the calculation of the test results of a steam engine, power reverse gear, locomotive road tests and tonnage rating tests.

The author omitted from his book any information pertaining to the testing of tender and car wheels, locomotive wheel centers and tires, glass, copper bearing steel, sheet metal, creosote for wood preserving, lumber and the testing of electric light bulbs and wire. These are essential railway materials and to make the book comprehensive should have received the same consideration as those actually covered.

In writing this book the author has inadvertently limited its usefulness by not considering the testing of material from the standpoint of the material inspector in the field. These men are always anxious to obtain any information which will aid them to make a thorough inspection of the materials they are called upon to inspect thereby protecting their interests as well as those of the railroad which they represent.

The elementary nature of the volume makes it suitable for the novice entering the testing laboratory and for the shopman whose desire is to take up the testing and inspection of materials.

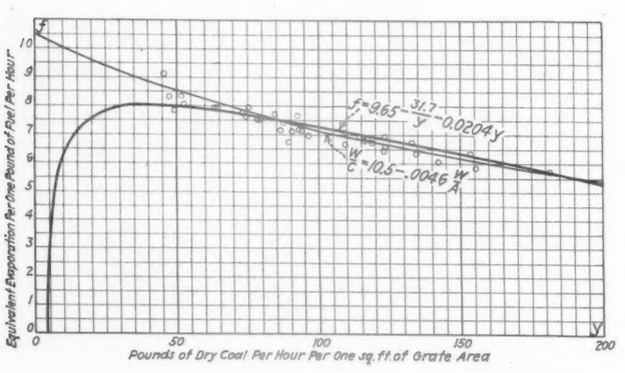
What Our Readers Think

The evaporative capacity of locomotives

Altoona, Pa.

To the editor:

The articles on "Evaporative capacity of locomotives," by Alexander P. Poperev, are certainly worthy of serious study since they vary in principle from generally accepted methods used heretofore. The theory presented involves more calculations than those of Dr. Goss and Lawford H. Fry. All three theories are empirical and necessarily cover arbitrary assumptions based on locomotive tests. These arbitrary assumptions differ materially. The additional burden of calculations will be justified only if the results are more accurate. Therefore, careful comparison of results of calculations, with test data available, should



Curve plotted on Fig. 6 from Dr. Goss's formula for purpose of comparison with the Poperev curve

be made before discarding the simple method of Dr. Goss for the more complicated method.

Dr. Goss's method which I have used for more than 25 years, was found adequate for the purpose and agrees closely with test results. It is true, as stated by Mr. Poperev, that there are heat losses from various causes, that coal can be burned on the grate without using any steam or increasing boiler pressure; but such losses are in the nature of "standby losses" which are, invariably considered separately. It is possible to estimate from the B.t.u.'s in a pound of steam and in a pound of coal, the theoretical maximum rate of evaporation per pound of dry coal. Allowances for heat losses and for coal losses, due to grade of coal and method of firing, can be deducted. The coal losses vary as much as 30 per cent at very low rates of combustion, between hand-firing and stoker-firing, but at high rates of combustion are nearly equal. They also vary for different kinds of stokers. But these losses, apparently, do not affect the nature of the curve which represents equivalent evaporation per pound of coal within the range in which a locomotive is worked on the road. All of the many tests made indicate that this curve, when based on increasing water rates, is a straight line. It is certainly proper to make assumptions for these losses, subtract them from the theoretical rate and establish the ratio of equivalent evaporation to a pound of dry coal for different rates of evaporation or coal consumption; but such arbitrary assumptions must be checked by tests, the results of which usually show that discrepancies from the estimated results are due to the grade of coal, or method of firing, or both.

Mr. Poperev failed to show a comparison of the methods which he criticized with his own, but condemned the other methods for technical reasons, which seem to be questionable, since they obtain only outside the range of action of a locomotive doing useful work. For a study of the value of his theory, some of the figures in his article can be analyzed to check his summary statement in the September, 1925, issue of the *Railway Mechanical Engineer,* page 554, reading: "On the contrary, by applying the same analysis to expressions, 17 and 21, we fail to find any similar contradictions, which fact can be considered an additional proof that the basic expression, (6) from which these formulas are derived, is correct."

Above this statement appears Fig. 6, giving results taken from Dr. Goss's tests with Mr. Poperev's formula for these tests and a line representing that formula. Not having a copy of those tests at hand, I have taken some of the points representing individual tests, from which Dr. Goss's formula would be:

$$W/C = 10.5 - .0046W/A$$

in which A is the area of the grate in square feet.

This formula, which is based on the rate of steam generated, translated to a basis of coal used, gives the results:

Dry coal lb. per sq. ft. of grate per hr.	25	50	75	100	125	150	175	200
W/C	9.44	8.54	7.80	7.20	6.67	6.22	5.82	5.47

Referring to the chart, it will readily be noticed that if these values are transcribed on Fig. 6, the resulting curve fits the tests much better than the Poperev curve.

Using the same method on Fig. 5, page 554, for efficiency, Dr. Goss's method would indicate the formula

$$E = .855/ (1 + .0072C)$$

The curve plotted from this formula again fits the tests much better.

In Fig. 1, page 488, of the August, 1925, *Railway Mechanical Engineer,* the formula for the top chart (B. & W.) boiler would be:

$$W/C = .236 - .0067W$$

for the center chart (Whitman's tests)

$$W/C = .257 - .0046W$$

and the bottom chart (F. R. R. test)

$$W/C = .16 - .0057W$$

It should be understood that since the formulas given above are based on the meager test data gleaned from the figures given with Mr. Poperev's articles, they are not necessarily accurate, but they do permit a comparison between the methods of Dr. Goss and Mr. Poperev.

Those interested in this subject may take the trouble to trace out the curves by these formulas. They will find that, by Dr. Goss's method, more accurate agreements with actual tests are obtained than by Mr. Poperev's more elaborate method. Hence, instead of having proved that the basic expression (6), from which his formulas are derived, is correct, he has presented evidence which enhances the value of Dr. Goss's method.

The Lawford H. Fry method has not been discussed in this letter, because his investigations were intended more for analysis of heat transfer and his assumptions for ratio of W/C are only incidental to that subject.

W. F. Kiesel, Jr.,
Mechanical engineer, Pennsylvania Railroad.

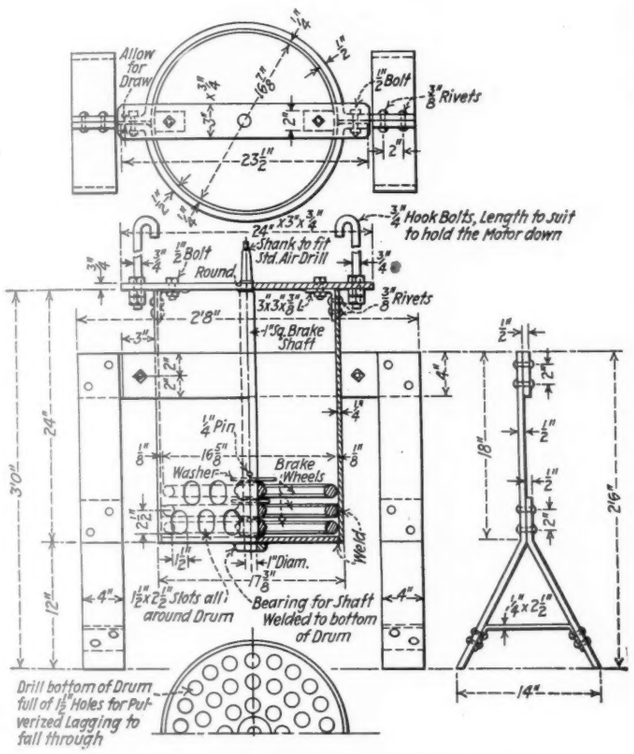
Reclaiming asbestos locomotive lagging

MILWAUKEE, Wis.

TO THE EDITOR:

I was interested in the letter from Theo. Nygren on the reclaiming of asbestos locomotive lagging published on page 541 of the September, 1925, *Railway Mechanical Engineer*.

It is an ordinary occurrence on many roads to find an accumulation or surplus of second-hand and small pieces of boiler lagging. There is no market suitable to dispose


Allow for Draw
1/2" Bolt
3/8" Rivets
23 1/2"
24" x 3" x 3/4" Shank to fit Std. Air Drill
3/4" Hook Bolts, Length to suit to hold the Motor down
1/2" Bolt Round
3/8" Rivets
3x3x3/8" L
2'8"
1" Sq. Brake Shaft
1/4" Pin
Brake Wheels
Washer
Weld
1" Diam.
17 3/8"
1/2" x 2 1/2" Slots all around Drum
Bearing for Shaft Welded to bottom of Drum
1/4" x 2 1/2"
14"
Drill bottom of Drum full of 1/2" Holes for Pulverized Lagging to fall through

Grinder for powdering used asbestos lagging

of this material is scrap and it often-times happens that the surplus finds its way to the dump. This lagging represents a value practically as good as new material and it is not absolutely necessary that new lagging be used in all cases. The second-hand lagging can be powdered and reduced to a plastic state and together with short pieces can be used for filling in around locomotive cylinders, steam chest steam pipes, domes, back boiler heads and for stationary boilers, steam pipes, feedwater heaters, etc.

If the second-hand material is first used for these purposes, there will be little or none left for compressing into blocks and new blocks for locomotive boilers only need be purchased.

An inexpensive power operated tumbler or grinder for powdering second-hand lagging can be constructed in almost any railroad shop. The drawing illustrates such a device. An air drill is used to furnish the power. The pulverizing consists of three hand-brake wheels at the bottom of the container. The top and bottom wheels revolve with the square shaft and the center wheel is bored out sufficiently for the shaft to turn inside of the hub. This wheel is held stationary by welding the rim to the wheel of the container.

C. H. BILTY,
Mechanical engineer, Chicago, Milwaukee & St. Paul.

Burning the woodwork on steel underframes

BROWNWOOD, Tex.

TO THE EDITOR:

I have just received the September issue of the *Railway Mechanical Engineer* and shall try to answer the question asked by F. W. Bason as to how fire affects the steel underframes of box cars that have had the woodwork burned off. The effect on the steel underframes will be one of two things. If water is applied to hasten the cooling of the metal, you will crystalize the steel. Some parts may be heated more than others, and to replace them in service may cause failure. On the other hand, if the metal is allowed to cool slowly, it will be inclined to anneal or soften. There will likely be a weakening owing to the slight temper in the steel. The frame will sag more easily, but will not break owing to crystallization.

A READER.

Treating hot driving boxes on modern power

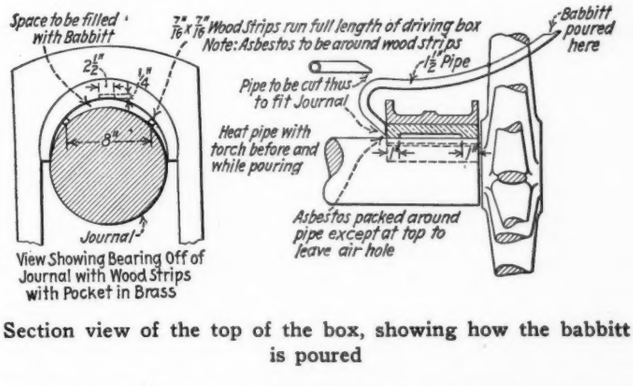
PERU, Indiana.

TO THE EDITOR:

The problem of treating a hot driving box or journal is one that has caused the mechanical department worry and especially when the transportation department is calling for more power. Having had considerable experience in shop work and also some years of experience as an engineman, I believe that I can write on the subject.

Dropping wheels for a hot box is a big job, even if it is done in a modern enginehouse and if the facilities are not modern, it is much worse. Whenever we have a box that has been reported several times as running hot, and after packing the box and giving it close attention and still we do not get the desired results, we jack the box off the journal four or five inches and with an air hammer, cut a pocket in the crown brass 2½ in. wide and ¼ in. deep, being careful not to cut out the ends of the brass.

We then take two pieces of thin wood, thick enough so that the metal, when poured will be ⅜ in. or 7/16


Space to be filled with Babbitt
7/16" x 7/16" Wood Strips run full length of driving box
Note: Asbestos to be around wood strips
Babbitt poured here
1 1/2" Pipe
Pipe to be cut thus to fit Journal
Heat pipe with torch before and while pouring
8"
Asbestos packed around pipe except at top to leave air hole
Journal
View Showing Bearing Off of Journal with Wood Strips with Pocket in Brass

Section view of the top of the box, showing how the babbitt is poured

in. thick. The box is then lowered on the journal and rests on the two pieces of wood, so that the bearing will stand about eight inches from the floor, after which it is packed with asbestos, a gate made and the babbit poured into the box. It is not necessary to remove the pieces of wood. Old piston packing having copper in it, that has been removed from superheated locomotives, gives a good bearing. This will apply to all driving boxes except the main box.

This method is something out of the ordinary and the work can be done in about six hours and the locomotive is ready to go into service.

J. E. ALLEN.

"Bill Brown" and "Top Sergeant"

One of "Bill Brown's" old shopmates backs him up— Day of bullying foreman is past

BECAUSE of the large number of mechanical association conventions which are reported in this issue, it is necessary to place severe restrictions upon the amount of space that we would like to devote to the "Bill Brown"—"Top Sergeant" controversy.

That "Bill Brown" in his first prize article in the June number painted an exceedingly clear picture of his early experiences, is indicated by the fact that two of his early shopmates recognized the picture and got in touch with "Bill," although he disguised his identity by writing under an assumed name. One of these men had neither seen nor heard of "Bill" for many years and wrote to us asking for information as to his whereabouts. The other one has been keeping in more or less close touch with "Bill" and has come to his aid under the signature of "Old Railroader," with a splendid contribution, which we take pleasure in passing on to our readers.

Mr. Maguire, whose letter we also print, suggests that "Top Sergeant" is a fake and that his contribution was probably prepared by one of our editors to, in effect, set up a "straw man" to knock down. It may be to the discredit of our editors that they were not ingenious enough to think of resorting to such a subterfuge, but we beg to assure Mr. Maguire and others who may have similar illusions, that "Top Sergeant's" letter was not written by a member of our staff and that its receipt not only came as a distinct surprise, but caused no little excitement in the editorial sanctum. As an effective answer to Mr. Maguire and others, we simply want to drive this question home. In thinking over your experiences and acquaintances, how many foremen and supervisors have you known or do you know who reflect in a greater or less degree the "Top Sergeant" attitude?

The letters from "Old Railroader" and Mr. Maguire follow:

A friend of "Bill Brown"

By "Old Railroader"

The first prize article on "The Foreman and His Responsibility" in your June issue by "Bill Brown" I read with unusual interest because its opening sentences about his having been a clarinet player in a certain band a number of years ago, and his graphic account of his foreman's interview with him, revealed to me that "Bill Brown" is none other than an old shopmate of mine, who is now one of my most intimate and esteemed friends.

That foreman of his, who was also my foreman, has long since gone the way of all the earth, and there is a Latin proverb. "Let nothing but good be said about the dead," but surely facts may be stated.

Well, I have read in your August number "Top Sergeant's" drastic criticism of "Bill Brown's" article, and from it I conclude that he is almost the exact counterpart of "Bill Brown's" foreman. This latter gentleman had a very exalted idea of his position. The king upon his throne, or the President in the White House was a small potato compared to a railroad shop foreman. He was "Sir Oracle and when he ope'd his mouth, let no dog bark." Yet he possessed no theoretical knowledge of mechanics. He was unable to make the simplest mechanical calculation. He scorned to read such publications as the *Railway Mechanical Engineer*. He perhaps had never heard of such a thing as a vernier, but he possessed one accomplishment. He was a rapid and beautiful writer, and the facility with which he could whip out his order book, and write an order for a man's discharge was only equaled by the facility with which Mr. "Top Sergeant" can show the gate to the man or men who do not please him. "Bill Brown's" foreman handled the apprentices in a way that would rejoice the heart of Mr. "Top Sergeant" and many a bright boy of sensitive nature he drove out of the shop by his harshness and cruelty.

How did he himself make out by his bull-dozing, ignorant brutality? Did he rise step by step till he reached the highest position in his line? No! He was put back to run a machine, and a sorry job he made of it. He jumped about like a bear on a hot gridiron and accomplished very little, while an elderly Scotchman near him accomplished a great deal. Yet the Scotchman was apparently slow and deliberate in his movements, but every move was in the right direction. Finally Mr. Ex-Foreman was discharged. He got a job overseeing the mixing of cement for the corporation. Then he went to work in a railroad shop in a neighboring city, and soon he died. Of course, we hope Mr. "Top Sergeant's" career will not end so ignominiously.

Mr. Editor, you spoke of Mr. "Top Sergeant" as "an old-fashioned, hard-boiled type of foreman." It is to be hoped he is the sole surviving member of the hard-boiled type of foreman.

"Bill Brown's" article breathes the gentler, more enlightened, more humane spirit of the present day. It recognizes the fact, for it is a fact, that better service can be obtained from men, by friendly, tactful handling, than by treating them as though they were mere "dumb driven cattle." His article reflects throughout his own splendid, large-hearted, common-sense personality.

In his suggestion of the new foreman calling his men together, and talking to them in the manner he outlines, he is in very good company. A newly-appointed president of a vast railway system, went from point to point on the system where large numbers of men were employed. He called them together in all their grime and addressing them in a friendly way, told them that the success of the system depended on the faithful and hearty co-operation of every employee with the management.

His suggestion as to the treatment of the new employee, which is humane and considerate, must meet with the approval of every right thinking person. No foreman can size up a new man in 20 minutes. Some men, and good men, too, experience on beginning work in a strange shop, something akin to "stage fright." They imagine they are the objects of critical attention. They are self-conscious and for a time are not their true selves at all. "Bill Brown" takes note of this and would help them through the period of strangeness.

His remarks on new tools or machinery, on the sales engineer, on the conservation of material, are all good and sensible, but the writer particularly likes what he says about the attitude of the foreman towards the apprentices. Despite the sneers of Mr. "Top Sergeant" it is

in line with what is being done by great railway systems —the Santa Fe, for instance—to train and educate their apprentices. It is being more and more recognized that hands are more skilful and efficient when directed by well-trained brains.

Mr. Editor, it was a pleasure to me to read this article from the pen of my old friend, "Bill Brown." It meets with my approval, for it expresses my own sentiments better than I could possibly have expressed them, and the fact that you saw fit to award it the first prize, shows that it meets with your approval also.

Foreman must prove worth as a leader

By George T. Maguire

Boiler inspector and gang leader, Delaware & Hudson, Whitehall, N. Y.

If publicity leads to fame, "Bill Brown" is due for a place in industry's "Hall of Fame." He sure did "start something."

In presenting my personal views on the subject of his article, I cannot help including my views on the article of criticism offered by the "hard boiled" foreman who, to make himself sound "hard boiled," appropriated the nom de plume, "Top Sergeant." At the start let me state that I firmly believe that the article was written by the "top kick" (whom I'll wager is employed, not as a foreman but as an editorial writer) to purposely prolong the discussion of Brown's article. That it will fulfill its purpose, I have no vestige of doubt. If this writer really tried to increase his hardness by calling himself "Top Sergeant" let it be understood that the title is a misnomer. The war tamed the hard boiled "tops," as modern practice in industry has tamed the bully foreman.

Regarding a foreman's expectation of receiving thanks from a workman. Why should a workman thank the foreman? What foreman worthy of trust would approve a raise in the pay of a workman if that man was not deserving? And if a man is deserving of the increase, will it not reflect creditably upon the foreman? Does it not show that he has made another man more efficient? Therefore the increase is a 50-50 proposition. It means that the company is showing its approval of the foreman's system of increasing production, for increased production is increased efficiency and the foreman is showing his appreciation to the workman for making the increase possible. Need the man be thankful in words to the foreman? Will not a continued effort mean more than any number of words of thanks? In this case the "Top Sergeant" would be holding grievances and this according to his own words would eventually result in the "canning" of the workman. Would he be a competent foreman in dispensing with the services of a man who has proven worthy of a raise, simply because he forgot to say "thanks." How much would he save for the company?

I wonder just what the "hard boiled" foreman means by "he man." Does he mean a man of massive proportions whose remarkable strength is apparent but whose lack of reasoning power is appalling? Roosevelt was called the "Red blooded he man President"; did he think only of himself and his personal viewpoint?

Then comes the "top's" views on railway journals. What a fraud this man turns out to be. What man ever advanced from apprentice to journeyman unaided? Perhaps our "top" was born with all his knowledge. If we can advance unaided why not start as superintendents of motive power or master mechanics at least? Why be a mere foreman. Let us suppose our hardboiled foreman to be about fifty; he perhaps has thirty-five years' service on the road, say twenty years as a foreman. He was a foreman in 1905 when the Walschaert valve gear was brought to this country, when superheated steam was born, when the No. 6 E. T. air brake was put on the market. Who taught him what he knows about them? What does he know of welding methods, of three cylinder engines, unless he has read of them in journals or has had them explained to him by those who have read these journals, or who have been sent to help him by the builders? He is a blood brother of the boilermaker who continues to bead flues by hand because the pneumatic hammer gives him a cold in the head.

Concerning relationship to other departments. All departments combined make the road; if one falls behind the road suffers. Should we co-operate? The "ayes" have it.

Now for "Bill Brown." Bill's plans of telling the men what he expected of them is O. K. but, as he says, later, all men cannot be talked to alike. I believe that Bill should have interviewed his men separately instead of calling them together in this way; he would be able to get each man's views on his promotion and establish a personal relation with his men.

It is not always a good policy to explain changes in management, shut-downs, cuts or short hours to foremen but certainly a foreman should keep in touch with business and working conditions and should be interested in new methods of getting work out and to gain this end it is necessary that he read modern mechanical journals.

A foreman should be kindly in his contact with men, not only with new employees but with all employees. He should, however, be strictly impartial. Instead of personally making the new man "at home," I think he should permit him to work with an old employee for a day or two, exercising care in the selection of the employee so that the proper shop spirit may be instilled in the recruit.

Improved machinery or new inventions should be studied so that they may be understood when eventually installed, but undue haste in advocating a change when the old machine is not obsolete and can do the work reasonably fast would be a breach of trust, because it would involve the unnecessary expenditure of a sum which might be used to a greater advantage somewhere else.

Knowing and bringing home to the workman a realization of the cost of material is a subject in favor of which too much cannot be said. It is an absolute misfortune that competitive methods prohibit the manufacturing companies publishing prices of machines and materials in the advertisements in various trade journals. If a railroad company published a list showing the price paid manufacturers for materials the cost of printing it would be saved in 3/8 in. nuts alone.

All material having any salvage value should be saved carefully; only sufficient material to cover the job should be drawn from the storekeeper. Material should be used and conserved as carefully as a good mechanic uses and cares for his tools.

The day of the bullying foreman and the foreman who takes an improper advantage of his position has passed. This is the day of the foreman who has proven his worth as a leader.

PRESIDENT W. J. HARAHAN, of the Chesapeake & Ohio, has authorized the purchase, at a cost of about $8,000,000, of the following equipment: 20 simple Mallet type locomotives; 75 Mikado, heavy type locomotives; 5 heavy Pacific type locomotives; 10 heavy type switch engines; 125 steel caboose cars; 10 all-steel combination passenger and baggage cars; 3 all-steel mail cars; 2 ditchers; 4 dump cars and 2 locomotive cranes. The company is now in the market for this equipment.

The foreman and his responsibility*

The "big boss" drops in on an imaginary staff meeting—Pertinent suggestions on discipline and conservation

By W. J. Taylor
General foreman, Southern Pacific Company Shops, Sparks, Nev.

WEBSTER'S definition of opportunity is: "Suitable time, combined with other favorable circumstances." One favorable circumstance must be that we shall be fitted by training, study and experience to accept the responsibility imposed upon a foreman.

The opportunities of a foreman in railroad work are unlimited. A glance at those who have succeeded and are holding high executive offices, demonstrates that those who have worked hardest, have been honest with themselves and employers and are morally and courageously firm and just are the ones who have succeeded. They have been able to concentrate their minds on each individual position as they have advanced, and their training and experience has enabled them to meet any emergency unruffled and with quick and able decision, given in a manner to command respect.

Opportunities sometimes seem slow in presenting themselves and many who are over ambitious become discouraged and lose heart at the very moment when promotion may have been within their grasp.

The foreman who cannot apply himself to his job with his whole heart, giving the best that is in him—even under adverse circumstances or criticism—will not succeed. The little demon jealousy must always be watched closely, as he can undermine and destroy the chances of an otherwise successful foreman.

It is a fact that many men have succeeded in securing advancement and recognition through their ability or gift of a good "flow of talk," but those men are generally lamentably weak in doing the real things that count. They usually maintain their precarious standing by informing their superiors that a suggestion or improvement made by Bill Jones was their own particular idea. We must, however, be thankful in knowing that there is now less chance of advancement for this class of man.

We must be experts in our particular line. Opportunity seldom presents itself to those who continually are compelled to say: "I do not know."

As for the so-called strategic position occupied by the foreman and his opportunity for strengthening the organization which he directs, or assists in directing, and making it function more efficiently, we should like to make the following observations:

An interesting staff meeting

Consider a railway terminal shop and roundhouse, with a total of fifty foremen in the motive power department and twenty in the car department. We will inaugurate a practice of holding semi-monthly meetings. The general foreman of each department takes charge of these meetings, which will be held separately for each department because of the widely varied topics which will come up for consideration. Such meetings to be held during regular working hours and to be attended by the heads of each department, and those assistants who can be spared. After the meeting has been opened, and the general foreman has spoken on such subjects as safety, production, co-operation, etc., suggestions are solicited. The results are really surprising.

Those comprising a supervisory staff in the majority of our railway organizations come from all sections of this country and from European countries. These discussions are therefore most instructive. Minutes of these meetings are taken and printed, and distributed to all foremen. Suggestions of merit are referred to the master mechanic, and perhaps higher.

The seventy foremen are especially skilled and intelligent; they were picked for supervisory duties because of this. They are directly responsible in disbursing perhaps $125,000.00 a month. (Some responsible task!) Might we suggest that the general manager of the railroad operating these shops scratched his head one day and said to his superintendent of motive power: "That is a lot of money to intrust to those men to spend each month.

"Let us go over and see if they are really capable." On arriving at the shops they are informed by the master mechanic that a foremen's meeting was being held and they accepted an invitation to attend.

After a few introductory remarks by the master mechanic, both the general manager and the superintendent of motive power make a few remarks and the meeting resumes open discussion. At the invitation of the general foreman the superintendent of motive power takes the chair. Bill Jones, machine shop foreman, gets up and wishes to respectfully draw the superintendent of motive power's attention to the fact that he is using an old wheel lathe, built in 1878, for turning tires on an engine that was purchased in 1924. Bill says he is wondering why the management did not think it necessary to keep up-to-date with its machinery as well as with its locomotives. Superintendent of motive power coughs, and says he will look into the matter.

Next, our roundhouse foreman gets up and states that he is using an old shop-made crane for loading coal into tenders that was made in 1900, and tells of another method with which he had loaded coal while working for the XYZ road. Many other matters are discussed and at the conclusion of the meeting the superintendent of motive power promises the foremen assembled that in the future he will keep his eye a little more closely focussed on them as he realizes they are back of him in producing at a minimum cost.

The foreman's responsibilities

The responsibilities of a well trained, honest, conscientious foreman are such that he should realize and appreciate at all times the trust that has been placed in him. He should have such intellectual and moral capacity as to be able to discriminate and choose between right and wrong. He is accountable to his employer in seeing that money expended under his supervision is wisely spent, that every man employed under him gives an honest day's

* One of the articles submitted in the *Railway Mechanical Engineer* competition on this subject. The first, second and third prize articles have appeared in the June, August and September issues, respectively. Interesting comments on the first prize article also appeared in the two latter issues—the famous "Bill Brown"—"Top Sergeant" controversy.

labor, that material is not wasted, that tools are carefully used and conserved; also that the morale of the organization, over which he supervises is kept up to the highest standard. Also that there is harmony and co-operation between supervisors, between supervisors and men, and between the men themselves. The attainment of proper co-operation between all units of an organization should be a responsibility that all foremen should accept and strive to achieve. Co-operation extending from the head of an organization, and embracing all members of the official family, with the foreman would no doubt tend to make the whole machine function more efficiently.

The pompous official does not sense his responsibility. The foreman and the highest official are (or should be) striving for the same results. In demanding an honest day's work a foreman must know his men, must know how the work should be performed and how much time should be consumed on each job. It is possible for a man to work hard for eight hours and accomplish nothing. Accuracy must be constantly encouraged to prevent the necessity of doing work over. Spoiling of work is generally the result of poor supervision, and added to the waste of money for time expended, the cost of material is usually doubled.

Efficiency cannot be maintained without discipline, but discipline in overdoses is like an overdose of food or medicine,—it makes one more sick. When censuring a man a foreman must be firm. Infractions of established rules must never be overlooked for one man and strict discipline be given another. Encourage your men,—a discouraged man is of little use.

Conservation of material

The conservation of material is a subject that deserves the closest study and the foreman who conserves "until it hurts" is one who surely senses his responsibility to his employer and recognition is sure to come his way. His responsibility should not direct that he should demand of the storekeeper that an enormous stock of material be kept on the shelves, but that no more material be kept on hand than is absolutely essential to the proper running of the plant without delays. By close observation he can anticipate his requirements far enough in advance to eliminate the necessity of large stocks being maintained. Patching and substituting are two practices which should be approached with caution.

The abuse and loss of tools of various kinds should demand the strictest attention. Tools issued and held in tool rooms, or given out to individuals, should be periodically checked and requisitions for materials should be carefully scrutinized by the responsible foreman, who should ask himself in each instance: "Is it absolutely necessary that this material or tool be issued?"

Here is an instance to illustrate how one foreman recognized his responsibility in conserving material: In a plant "once upon a time" it was the custom of the machinists to use white lead on boiler studs, etc., before screwing them into place. The pipe fitters used this same material on pipe fittings. The boilermakers and mechanics got the habit and it was no unusual sight to see little pots, possibly a pipe cap or pieces of paper with white lead on them scattered promiscously around the shop. Suddenly there was an order that no more white lead should be issued for this purpose. Result—saving of many dollars and the work went on just the same.

The average foreman has an intellect that is fertile, capable of development. With encouragement coupled with harmonious co-operation and recognition from his superiors, the foreman is generally eager to grasp the opportunity if it presents itself, and through this sense of responsibility will seldom fail to make good in any task imposed upon him.

Traveling Engineers hold successful convention

Report on mechanical stokers and paper on train control feature annual meeting at Chicago

THE Traveling Engineers' Association held its thirty-third annual convention at the Hotel Sherman, Chicago, September 15 to 18, inclusive. There were about 1,000 members and guests in attendance at the opening session. The report of the secretary showed that the association had 105 new members and 252 members reinstated during the past year, making a total membership at the present time of 1,593.

The opening address was made by W. J. Fee, road foreman of engines, Canadian National, Lindsay, Ont., and president of the association, whose remarks are abstracted below. The association was also addressed by C. G. Bowker, general manager of the Grand Trunk Western, Detroit, Mich., who called attention to the splendid opportunity which members of the Traveling Engineers' Association have of improving locomotive service on the railroads through papers presented at the annual conventions and subsequent discussion. Mr. Bowker said that while the traveling engineer's duties are many, they all are important. He must keep a close supervision upon the power assigned to his territory, riding the engines frequently and keeping in touch with their condition. He must instruct engineers in the proper method of handling engines and see to it that they keep water at the proper level in the boilers, especially on superheated locomotives. He must see that his engines are properly lubricated in order to prolong the life of the cylinder packing and obtain the greatest possible efficiency in operation. Mr. Bowker also emphasized particularly the opportunity of the traveling engineer to improve locomotive performance through the prevention of carelessness and inattention to duty responsible for engine failures and also to a large extent for excessive fuel consumption.

The opening address made by President W. J. Fee, road foreman of engines, Canadian National Railways, Lindsay, Ont., was in part as follows:

Address by President W. J. Fee

Efficiency in railroad work is a matter of education and experience, and is mostly obtained through association with each other and exchanging the views of each

other's experience. Give us the benefit of your experience, and we will keep our members in position to aid in bettering locomotive service on their various railroads. Our superiors will then be satisfied that it is to the interest of every railroad to send its traveling engineers to these conventions to keep them informed as to the latest developments in connection with locomotive equipment and operation.

No association can boast of a wider zone of usefulness, or a better record of achievement than this one. Transportation is the oldest and the newest problem confronting civilization. Transportation has been essential to human well-being and happiness, and has perhaps more accurately reflected human progress and achievement than any other industry, not excepting agriculture.

The locomotive being the prime factor in railway operation, the history of its development is a romance which has no parallel in the records of human achievement, nor can too much credit be given the men whose stupendous labors brought into practical form such devices as the air brake equipment, feed water heater, superheater, stoker, booster, power reverse gear, different valve gears and many of the numerous devices now applied to the present day modern locomotive.

Due consideration should be given to the construction of locomotive tenders to provide fuel supply for the use of the fireman who either through lack of knowledge in the operation of the stoker or because of a clog occurring may be required to revert to hand firing. As a rule in case of stoker trouble a fireman will make added efforts to hand fire the locomotive if fuel is available without restriction. This will also increase the tendency of firemen to give proper consideration to the use of the scoop during standby and other delays, at which time the temperature of the fire-bed may become low, and if without forethought extreme care is not taken banks may form over the fire-bed through the use of the stoker.

On territory where the application of mechanical stokers is being considered it is important to establish the practice of removing all foreign and non-combustible material at fuel stations and coal mines. Delays will be eliminated by establishing this practice and continuity of operation assured to stokers, thus preventing interruption of service at critical periods of operation during sustained efforts on the part of the locomotive.

The inclination of individuals to study and qualify for promotion has through the application of the stoker shown itself on the increase. The present progressive examination is of such a nature that earnest study must be applied for an individual to qualify from the position of fireman to that of a locomotive engineer.

W. J. Fee (Canadian National)
President

J. N. Clark (S. P.)
1st vice-president

J. B. Hurley (Wabash)
2nd vice-president

Progress made in mechanical stokers

Up to June 1, 1924, 8,989 mechanical stokers had been applied to locomotives.

From information obtainable and from personal observation it should be possible for a mechanical stoker of the present-day type to operate approximately 90,000 miles on the locomotive before receiving a general overhauling; however, at the time the locomotive is receiving classified repairs the stoker should receive a thorough inspection and the necessary light repairs be made. It is presumed with reference to the above that the stoker and parts received proper lubrication and correct operation.

Maintenance costs 0.1 to 0.15 cents per locomotive mile

From information available, at sources where inquiries were made, as to actual differential covering cost and maintenance of past types of stokers over that of the present-day type, no figures were to be had; however, the standard type of stoker in operation today can be maintained for approximately 0.1 to 0.15 cents per locomotive mile.

This includes the cost of all stoker parts used at overhauling; however, minus cost of labor.

Influence of stoker on detection of packing blows

Valve and cylinder packing blows should be observed with extreme care. Engine crews should be instructed in the art of testing for them. As the mechanical stoker can and will deliver the required fuel before the weakening of the locomotive due to loss of power is discernible, certain engine crews are not entirely familiar with the proper method of discerning and testing for valve and cylinder packing blows, especially so in the case of superheated locomotives.

Special attention should be given to replacement of stoker parts, as well as maintaining the openings in the firing nozzles, distributing arrangement and true alignment of such parts by the roundhouse forces.

Operation of stokers on inbound or terminal tracks, prior to the arrival or after leaving of crews, except by inspectors, should not be permissible. It is important that fire-beds be built up at terminal points and delivered to the crews in a light and level condition and free from clinkers. Prior to leaving the outbound track the whole stoker should receive close observation of the engine crew, in order to know that it is in serviceable condition and that

the flow of fuel is available. Fire-beds should be built up by hand-firing and a proper degree of heat obtained. The thickness of the fire-bed is to be in proportion to the degree the locomotive will be worked and according to characteristics of the fuel used. Engineers should gradually work their locomotives up to the maximum working capacity needed, rather than in a sudden manner, allowing the firemen to bring the fire up to the proper degree of heat, depth and division of fuel over the grate area as a whole, so that forcing of the fire may not be required. This will insure getting the fire-bed at what we term a light, bright and level condition, which is necessary for securing the most economical results in consuming the volatile gases of the fuel with resultant barometer of efficiency—a clean stack.

Modern stokers promote reliable operation

The schedule of the time table makers and tentatively expected performance of the extra as well as the regular trains by the dispatcher is based upon the even, steady and continuously normal performance of the locomotive. By no other presumption can the plans of the dispatcher become definite. Dispatchers must have certain confidence in locomotives as well as in engine crews to perform certain tasks. These tasks, regardless of weather conditions, the modern locomotives will do, even though called upon to develop in comparatively short time rates of horsepower from zero to a total maximum effort. With the mechanical stoker, dispatchers feel assured that they have a locomotive with which there is no doubt of failure resulting from the physical effort on the part of the fireman in being unable to maintain constant pressure under sustained effort.

The report was signed by D. I. Bergin, chairman, road foreman of engines, Wabash; J. P. Britton, road foreman of engines, B. & O.; J. H. De Salis, master mechanic, N. Y. C.; M. A. Daly, fuel supervisor, N. P.; and Henry H. Wilson, general road foreman, B. & O.

Discussion

In discussing the committee report on mechanical stokers, various members emphasized the points brought out in the report that the modern stoker of improved design is practically foolproof in operation, low in maintenance cost with reasonable care and attention to lubrication, and decreases railroad operating costs. Practically without exception, comments on the report were favorable. Decreased operating cost is accomplished because the stoker makes possible an increased tonnage rating of locomotives, prevents many train delays due to man-failures in firing and under certain conditions saves fuel over the older method of hand firing. In addition, the advantage of the mechanical stoker as a safety device was emphasized in that it enables the fireman to keep a closer watch for roadway signals which may be missed, particularly if he has just put in a fire and is partially blinded by the intense glare from the firebox. In commenting on maintenance, one of the members said that the stoker engines on a series of locomotives built in 1913 have never yet been taken from under the locomotives, all repairs having been made at outlying points with the stoker engines still in place.

Continuous train control with cab signals

By E. Von Bergen
General air brake and lubricating engineer, Illinois Central, Chicago

At this time last year there were but four installations of train control that could be termed service installations, the remainder being test installations. Of the four, three were of the intermittent contact type, viz., the Miller on the C. & E. I., the Regan on the C. R. I. & P., and the American on the C. & O., and one of the continuous induction type, viz., the Union on the Pennsylvania. Since that time practically all of the remaining 45 roads embraced in the first order issued by the Interstate Commerce Commission have contracted with manufacturers for their respective installations, quite a number having a division in operation.

J. D. Heyburn (St. L.-S. F.)
3rd vice-president

James Fahey (Nickel Plate)
4th vice-president

R. Hammond (N.Y.N.H. & H.)
5th vice-president

W. O. Thompson (N. Y. C.)
Secretary

Contact type rendered obsolete

As none of these roads have selected a contact type of device, but have all chosen induction types, either of the intermittent or continuous type, it is apparent that railroad operating officers who have studied the problem are practically unanimously of the opinion that the development of the induction types has rendered the contact types obsolete. The objections which have for years been set forth against contact types, viz., clearance problems, shock resulting when locomotive apparatus comes in contact with wayside, interference of ramps with snow plows, etc., were overcome with the development of the induction types, and once it was proved conclusively that the wayside indication could be transferred aboard the locomotive positively and reliably without any contact between locomotive and wayside apparatus, and this at approximately

the same cost, the death knell of the contact types was sounded.

Intermittent vs. continuous

Although an intermittent type of device meets the requirements of the I. C. C. and generally speaking the first cost of any division installation of the continuous type is substantially greater than that of the intermittent, there is little benefit to be derived from an intermittent device unless speed control is incorporated, and the disadvantages of speed control will be discussed later.

With an intermittent automatic stop, all that can be expected is that the device will apply the brakes and stop the train in the event the engineman fails to stop for a stop signal, or to take proper action recognizing same. From a practical viewpoint, it is apparent that if two or three hundred thousand dollars must be expended for an automatic stop, it is good business to spend 30 per cent or even 50 per cent more, if funds are available to purchase a continuous stop device which will not only provide all that is provided by the intermittent device, but will in addition provide a continuous light signal in the cab keeping the engineman advised at all times of the condition of the track ahead. This device will also apply the brake at any point in a block when conditions ahead change from "clear" to "danger" instead of performing this function only when passing a fixed point at the entrance to a block. Conversely while a train is traversing a "red" block, and conditions ahead change to "clear" the condition is immediately reflected on the locomotive, and the engineman is free to proceed at full speed. This will very often facilitate operation, whereas with an intermittent device the train under these conditions would be restricted throughout the block to that speed imposed by the indication at the entrance to the block.

Another substantial advantage provided by the continuous cab signal is that with its use the present rule requiring a train to stop at a "stop and proceed" automatic block signal becomes entirely unnecessary. The cab signal should show but two indications, viz., either green or red. As one of these indications is constantly confronting the engineman in the cab, the present rule should be changed to read: "A green cab signal indicates track ahead is clear and authorizes maximum speed. When cab signal changes to red, the speed of the train must immediately be reduced to that at which train can be stopped within distance track is seen to be clear."

It is essential that an audible cab signal, preferably an air whistle, be provided to sound when cab light signal changes from green to red, to attract the engineman's attention, should he be looking away when the change occurs.

Forestalling feature

The forestalling feature is a device incorporated in an automatic stop, so arranged that when operated by the engineman within a given period before and after the train control apparatus on the locomotive receives a stop indication from the wayside, a brake application is prevented, and the engineman is free to control his train and manipulate the brakes as his judgment dictates. If he fails to operate the forestalling device within the time allotted, the brakes will be applied and the train brought to a stop regardless of any action he takes. When Order 13413 was first issued by the Commission, the forestalling feature was prohibited. This made the installation of an automatic stop on nearly all large roads entirely out of the question, as a train would be brought to a stop every time a stop indication was encountered, regardless of the action of the engineman, and in numerous cases would have imposed two stops where one is now required. It would also have required doubling of hills by many heavy freight trains on roads where automatic block signals with tonnage signals are employed. This would have produced an intolerable operating condition, and many roads were thus forced to select devices embracing speed control at a vastly increased cost and involving complicated mechanism difficult to maintain. In its decision handed down in July, 1924, covering the hearing on the second Order 13413, the Commission modified its first order to the extent of allowing the use of the forestalling feature, but reserving the right to withdraw this permission at a future date if found necessary. This has been the means of saving large sums of money that would have been expended for speed control apparatus. The theory on which the forestalling feature had been objected to was that an engineman might forestall a brake application and run into collision with another train in a manner similar to cases which have occurred when automatic block signals were disregarded; but an automatic stop has been in service for more than ten years on one road and no accident has ever occurred that could be attributed to the use of the forestalling feature. It may be said that possibly no accidents would have occurred on that division if no automatic stop or train control had been employed, and there is, of course, theoretical basis for argument that a collision might occur through the abuse of the forestalling feature by an engineman, but it is difficult for us as practical men with years of locomotive experience to conceive that with a continuous cab signal an engineman would deliberately disregard a red light staring him in the face in the cab and proceed to collide with another train.

Speed control vs. automatic stop

Any train control apparatus on locomotives requires a high degree of maintenance, but with speed control added, this is increased. The experience of the writer has shown that of the maintenance troubles arising, a large proportion (probably 50 per cent) develop in the speed control mechanism. It has been shown that with properly trained men and intensive supervision, the stop apparatus, both electrical and pneumatic, can be maintained in good working order, but even with the highest degree of maintenance many troubles occur in the speed control apparatus, causing undesired stops and cutting out of the device en route. Numerous tests have developed that the lowest speed at which it is practical to establish the functioning of the speed control apparatus on long freight trains is 20 miles an hour; in other words, if it is set to impose a lower speed restriction it will apply the brakes when this speed is exceeded, and although intended to release the brakes and allow the train to proceed immediately the speed is reduced below the restriction, it does not so work out in practice and the train is brought to a stop. This also frequently occurs when the speed is set at 20 miles an hour. Analysis of all the collisions which occurred on one large railroad for 10 years past developed there was not one instance where an engineman had passed a stop signal and was aware he had passed it that the speed of the train at the time of the collision was greater than 15 miles an hour. With such a record it would be folly to expend the large sum required for the purchase of speed control apparatus, as well as to incur the heavy maintenance cost of and troubles involved in an apparatus which can only be expected to limit the speed of train to that which is substantially higher than those at which collisions occur under conditions which it is presumed to prevent.

Speed control is a beautiful theory, and many theoretical arguments can be advanced by technical men to prove its necessity, but when its functions are analyzed on a practical basis, it is difficult to justify its existence, except possibly in cases where unusually dense traffic prevails

and it is necessary to operate many fast trains on very close headway.

Elimination of wayside signals

With a continuous induction system, incorporating visual cab signals, there appears no good reason why wayside block signals cannot be dispensed with. Practically the only objection to this procedure is that in the event of failure of the electrical apparatus on the locomotive the engineman would be left without any indication whatever of track conditions ahead. The answer to this is that there are thousands of miles of track being operated safely and efficiently today without wayside signals of any kind, and with the remarkable development of continuous induction types of automatic train control during the past few years we have a right to expect them to function as reliably as automatic block signals. Even if more failures of this apparatus occur than with automatic block signals, an occasional train can surely be depended on to safely traverse a portion of a division without the aid of signal protection.

Split reduction vs. continuous reduction

Volumes have been written on the air brake action when the brake pipe reduction is brought about by the train control apparatus. On account of recommended practice covering manual manipulation of the brake valve requiring the application of the brakes to be made with a split reduction, chiefly to allow slack in long trains to bunch before the full application is accomplished, many air brake experts insist that the train control apparatus apply the brakes with a split reduction also. One of the most prominent train control manufacturers urgently recommends this feature. The incorporation of a split reduction feature further complicates an already complicated device. The Illinois Central made braking tests on heavy freight trains ranging in length from 63 to 102 cars at speeds of 8 to 38 miles an hour, and on ascending and descending grades. Tests 1 to 14 inclusive were made with continuous reductions, the brake pipe venting until the train came to a stop, which is the method usually employed with an automatic stop. Tests 15 to 29 inclusive were made with a 7-lb. initial reduction, followed in five seconds with a 17-lb. reduction, which is the method employed by one of the leading train control systems embracing speed control. It is extremely interesting to note that in none of these tests was a stop attended with a shock that could be termed severe.

The writer has also witnessed many other tests, with both split and continuous reductions with train control during the past three years, on ascending and descending grades, throttle open and throttle closed, and in no case did any damage result from a continuous reduction. In tests where the throttle was closed and the brake pipe reduction started at the same instant on freight trains of 100 or more cars at speeds of 10 miles an hour or less, slack ran in at the rear end with a severe shock with either a split or a continuous reduction. When the brakes were applied at any speed and the throttle held open to stop, the slack action was in no case severe.

In the light of these tests, and in view of the fact that with an automatic stop incorporating a forestalling feature, the brakes will very seldom be applied by the automatic train control apparatus. The additional expense and complications involved by the split reduction apparatus are not warranted. Where speed control is employed, the split reduction may possibly at times fulfill a useful purpose, as unexpected brake applications will be received more or less frequently.

Conclusions

When financial conditions permit the installation of the most desirable device, an automatic stop of the continuous induction type incorporating the following features is recommended:

1—Continuous visual cab signals.

2—An audible cab signal to attract the attention of the engineman to a change of indication from clear to danger.

3—So designed that the engineman, if alert, may forestall a brake application within a stipulated period of time.

4—Engineman to have an interval of approximately 10 seconds before to 10 seconds after the cab signal changes to "danger" in which to operate the forestalling feature.

5—If the engineman fails to operate the forestalling feature, a brake application will result and continue until the train is brought to a stop.

6—Brake pipe reduction to be at the same rate as a manual service, but to continue until train has come to a stop.

7—Apparatus to consist of the smallest possible number of parts to provide these functions and meet the requisites of the I. C. C.

As the modification of the first order by the Commission, following the use of the forestalling feature, means the saving of vast sums of money in installation and maintenance costs for the railroads compelled to install train control, and selecting automatic stops, and also provides for the least possible interference with the engineman in operating the locomotive in his charge, the members of this assoication can lend invaluable assistance by impressing as forcibly as possible upon the enginemen under their jurisdiction the extreme importance of using the forestalling feature only when they are certain no hazard is involved. If enginemen should make use of this invaluable feature indiscriminately or carelessly and this practice result in a serious collision, it is not unlikely that the Commission would withdraw the permission granting its use, which would force the application of speed control with its complications, troubles and excessive cost.

Discussion

A representative of the Michigan Central stated that this road has abandoned its 20-mile test installation of the continuous train control and is proceeding to install two divisions of the intermittent inductive train stop. He therefore wished to defend the decision of his road in such choice against the argument presented by Mr. Von Bergen. He said that the intermittent inductive type is simple, requires a minimum amount of change in the wayside signaling and meets the requirements of the Commission. He considers the wayside signals absolutely necessary and believes that the majority of locomotive enginemen are not in favor of eliminating wayside signals.

J. B. Stewart (M. P.) reported that the Missouri Pacific has a complete engine division in operation under train control of the intermittent inductive type which is operating with entire satisfaction. He therefore wished to take issue with Mr. Von Bergen as to any concerted approval of the continuous or any other type at this time. Mr. Stewart explained that at certain locations on curves or on bridges speed restrictions are enforced by speed magnets which operate the train control to stop the train in case the speed is over 25 miles an hour.

E. Wanamaker (C. R. I. & P.) stated that the Chicago, Rock Island & Pacific has been operating a complete engine division under train control protection of the intermittent ramp type with speed control for the past 18 months and that results have been satisfactory in spite of severe winter weather.

L. F. Howard (Union Switch & Signal Company) stated that his company is prepared to furnish apparatus to give either the split reduction or the continuous reduction, whichever the railroad desires. On double track there may be the liability of accidents caused to other trains due to buckling of train where continuous reduction is used that might be eliminated by the split reduction. In explaining the desirability for speed control Mr.

Howard said that braking distance can be fixed only when speed is considered and that the function of speed control is to limit the speed on approaching the brake application point such that the train will be stopped in a fixed distance. It was also his contention that speed control is quite desirable in occupied blocks. In Mr. Howard's opinion the cab signal can be developed to be as reliable as the wayside signal. However, this function will depend on future developments.

C. A. Lyons (Regan Safety Devices Company) brought out that there are certain places such as in yard limits on bridges and in tunnels where train stops are undesirable and that such stops may occur with the continuous system but not with the intermittent system because the braking points are fixed in the latter system. He explained that with speed control the train can be continued in motion at a definite speed, thus facilitating movements and eliminating stops. Mr. Lyons answered one objection to the ramp by stating that notches can be cut in the aprons of spreaders, snow plows, etc., to clear the wayside ramps satisfactorily. If proper sized exhaust ports are provided Mr. Lyons stated that in his opinion continuous reduction will give satisfactory air brake operation on almost any road.

E. Von Bergen (I. C.) in closing the discussion on his paper, answered several of the points brought up. He agreed with the Michigan Central representative that wayside signals should not be eliminated if the intermittent train stop system is used. However, in his opinion many enginemen will prefer a cab signal to wayside signals if given their choice after experience with both. In reply to Mr. Lyons he said that in his opinion if conditions are such that the train should be stopped, the quicker it is stopped the better, regardless of the location and without waiting until a designated point is reached.

Results of improper handling of locomotive and air brakes

Assuming that good judgment and sound principles have been considered in making rules and laws governing the building as well as operation of brakes on trains, the first thing to consider is the maintenance of this equipment so that it will respond when desired according to laws and rules that were made to work with the builder, as well as to the operator's ideas and instructions.

If this is done, the next thing to consider is the good judgment of the engineer in the operation of the locomotive and brakes to avoid violent slack action in applying or releasing the brakes when slowing or stopping a train.

It is the opinion of the committee that with long freight trains many draw-bars and draft riggings are damaged and severe shocks in slack action (damaging the lading) result from closing the throttle abruptly applying the brakes on the engine at the same time as on the train before the slack has had time to adjust or bunch, and releasing the brakes while the train is in motion with the head end moving faster than the rear.

In connection with piston travel the commitete calls your attention to Table I, which shows the difference in cylinder pressure and effective braking power with piston travel of various lengths, as compared with that of eight-inch travel. Table II shows the equalization pressure in brake cylinders from four to twelve-inch travel with the respective brake pipe reductions.

The fundamental enemies of the modern air brake are uneven piston travel and leaks. Uneven piston travel causes a variation in every operation of the air brake system.

Table I gives the results of test made to show what is done in a service application with a ten-pound reduction of brake pipe pressure. As a matter of fact, the results actually obtained in service will be from two to three pounds lower than shown in the table on account of leakage, etc. (When the above tests were run there was no leakage and everything was air tight.) The effective braking power is that which would be delivered to the brake shoes for the cylinder pressure given. Assuming that the leverage is designed for 60 per cent braking power at 50 lb. pressure, this percentage being now recommended in freight service for steel cars or wooden cars with steel underframe. In practice eight-inch piston travel is usually taken as standard for freight service.

Table I

Piston travel	Cylinder pressure lb.	Effective braking power Per cent	Comparison with 8-in. travel Per cent	
4-in.	52½	63	130	greater
5-in.	41	49	78	greater
6-in.	34½	39	44	greater
7-in.	27½	33	20	greater
8 in.	23	27½		
9-in.	19	23	16½	less
10-in.	16	19	31	less
11-in.	13	15½	44	less
12-in.	11	13	53	less

The proper piston travel is that which will develop approximately 50 lb. cylinder pressure when the auxiliary

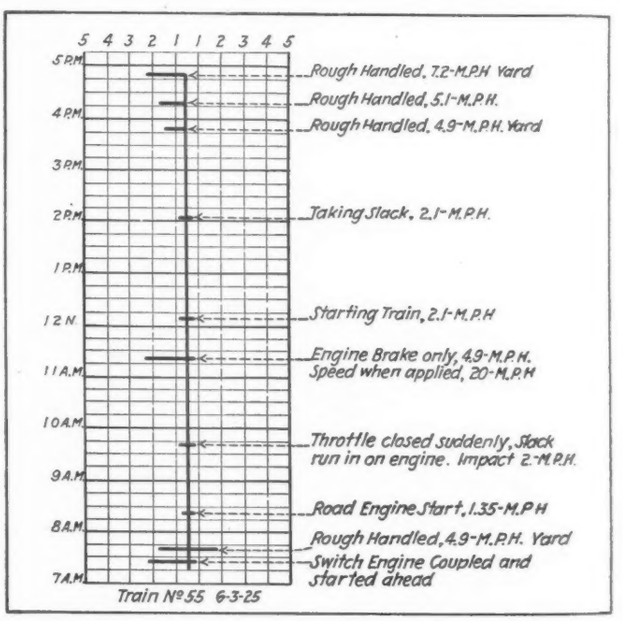


Fig. 1—Record of impact machine with 62-car train

and brake cylinder pressures become equalized from an initial brake pipe and auxiliary reservoir pressure of 70 lb. when a 20-lb. brake pipe reduction is made. This 50-lb cylinder pressure will then be the limit of a full service application, and should be obtained simultaneously on all cars. Table II shows approximately the pressure at which the cylinder and auxiliary reservoir above mentioned will become equalized for different piston travels, and the brake pipe reductions required to give this equalization.

Table II

Piston travel	Equalization pressure	Brake pipe reduction
4-in.	59 lb.	11 lb.
5-in.	57 lb.	13 lb.
6-in.	55 lb.	15 lb.
7-in.	55 lb.	16½ lb.
8-in.	51½ lb.	18½ lb.
9-in.	50 lb.	20 lb.
10-in.	49 lb.	21½ lb.
11-in.	47 lb.	23 lb.
12-in.	46 lb.	24 lb.

Particular attention should be given in this table to the large variation in brake pipe reduction, the short piston

travel requiring a smaller reduction and equalizing at a higher pressure than in the case of longer travel.

In proof of the committee's contention that 85 per cent of rough handling is done in yards, we call your attention to Fig. 1, which is a chart taken from a 62-car train. The impact machine was placed in the tenth car from the engine and it shows that 2.1 miles per hour was the greatest impact on the line of road, except that at 11:30 a.m. the engine brakes were used purposely to see just what the impact would be with a speed of twenty miles per hour and the slack gently bunched. Even with this light handling of the independent brake valve, the impact was 4.9 miles per hour, while the machine showed that the car was rough handled in both terminals.

In conclusion the committee wishes to call your attention to the freight claim expenditures (for 1924 on 95 per cent of U. S. and 65 per cent of Canadian mileage):

Damage due to rough handling	$9,584,984.00
Unlocated damage	8,273,312.00
Concealed damage	2,148,475.00
Freight train car repairs (1923 report for Class I Roads, U. S.)	153,509,170.00
A total of	$173,515,914.00

The report was signed by James Fahey, chairman, traveling engineer, N. C. & St. L.; N. Suhrie, road foreman of engines, Penna.; R. Hammond, road foreman of engines, N. Y., N. H. & H.; C. H. Dillinger, air brake supervisor, N. Y. C.; and H. W. Sefton, supervisor locomotive and fuel performance, C. C. C. & St. L.

Discussion

At the close of the reading of this report an extended discussion took place. One member questioned the need of automatic slack adjusters since if the piston travel is correct when a train leaves the terminal it will be the same at the end of the run save for a small fraction of an inch additional slack due to brake shoe wear. It was pointed out that after the first brake application the engineer feels the slack action of the train and must govern himself accordingly in future brake applications. In the main, the contention of the committee that most desirable brake action is secured when the slack is kept stretched and the brakes applied before the throttle is closed was upheld. H. H. Burns, Westinghouse Air Brake Company, agreed with a previous speaker in questioning the advisability of placing as much emphasis on piston travel as was done in the committee's report. While insisting that a constant effort should be made to improve the standard of air brake maintenance including recommended piston travel, Mr. Burns said that the improvement within the past year or two has been such that irregularities in brake action due to non-uniform piston travel are far less serious than those occasioned by the combination of loaded and empty cars in the same train with disproportionate braking power. Moreover, the drop in pressure at the end of a 100-car freight train, which may be as much as 15 lb., will occasion a greater variation in braking power between the front and rear cars of the train than would be caused by considerably more than the usual variation in piston travel.

Mr. Burns also commented strongly on the damage (often concealed) done by trying to spot locomotives for coal or water without uncoupling from heavy drag freights. He pointed out that while road foremen and sometimes two or three of their men may be able to do this successfully, by far the great majority of enginemen cannot spot a heavy tonnage train at a water standpipe or coaling station without unnecessary rough handling. The general conclusion was that no hard and fast rules can be adopted regarding this matter, which must be left more or less to the judgment of the engineman, depending on conditions. At the conclusion of the discussion the Association voted to adhere as closely as possible to the general rules laid down by the air brake companies for brake operation and in addition make brake applications with the slack stretched as recommended by the committee.

Appliances for lubricating locomotives

Until recently the hydrostatic lubricator of various designs had been the only medium used for applying oil, but with the advent of larger locomotives it has been felt that a device should be produced which would fulfill these functions more efficiently. With this end in view, the mechanical or force feed lubricators of various designs have been placed on the market, and have been applied to a considerable extent. Your committee has sent out a questionnaire to the membership with a view of securing information as to the degree of success secured from the application of the force feed lubricators; also, how their operation compares with the hydrostatic lubricators. The replies received would indicate that while a great number of those lubricators have been applied, they have not been in service long enough to secure definite data as to their efficiency as compared with the hydrostatic lubricators.

Each of the two types of lubricators has its separate merits and defects. For instance, by applying the hydrostatic lubricators to the large modern engines, it has been felt by some that because of the great length of the oil delivery pipes serious difficulties were being introduced in delivering the oil successfully to the valves and cylinders.

Not being able to secure any definite data comparing the hydrostatic and mechanical lubricators, the chairman of this committee will give his personal observation. We have applied mechanical force feed lubricators to our mountain type locomotives operating in heavy fast passenger service and have secured very satisfactory results. Certain defects were encountered, but with the experience we have gained these are readily overcome. The chief defect was choke valves leaking, which allowed steam to back up in the oil pipes and condense in the oil chamber. This condensation settled to the bottom and in some cases was of such a volume as to float the oil above the intake of the pump. This defect can be easily detected and remedied by the simple practice of opening the drain valve at the bottom of the lubricator and if water appears, this is an indication that a leaky choke valve exists and requires attention. Our staff has now been instructed and trained to watch this feature. The result is that this defect has now been practically eliminated. There are also instances where the lubricator apparently did not feed on one side. The cause of this was found to be choke fittings corroded and seized.

Some authorities claim that a lubricator should feed an amount of oil corresponding to the speed of the locomotive. This is not good reasoning, because the volume of oil required for lubrication is not always in proportion to the velocity, or to the area rubbed over. Especially is this so when the temperature of the rubbing surfaces is increased by some other agent than friction, which greatly reduces the viscosity of the lubricant and destroys the oil film in a very short time.

On this account the volume of cylinder lubrication would be regulated more by the cylinder temperature than by the area rubbed over. Assuming, then, that on account of occasional high water or bad water the oil film on the cylinder walls has been destroyed, how is this lubricating film to be restored if the volume of lubricant cannot be immediately increased? I might say that this film can be restored with the mechanical lubricator by lengthening the

cut-off, which generally would come in line when a condition of this kind arises. With a hydrostatic lubricator it would be necessary for the locomotive engineer to readjust the feeds.

The oil film is also often destroyed by the admission of front end gases to the cylinders when they are at high temperatures, and it must again be built up by the admission of a little excess oil, because the regular feed only supplies the necessary amount to replace the regular wear of the film, and cannot be expected to build up a new film. The lubricator must be equipped so its capacity can readily and quickly be adjusted to meet requirements.

Among the replies received to the questionnaire sent out was one from the London Midland and Scottish Railway, stating that this railway has 513 locomotives equipped with mechanical lubricators. They have no locomotives equipped with either the two-feed or the four-feed lubricators for oiling valves and cylinders, but a large number of their engines are fitted with eight-feed mechanical lubricators, and they also have three-cylinder compound passenger engines fitted with twelve-feed mechanical lubricators. In regard to the type used, they state that the mechanical lubricator used is of their own design, each oil supply being fed by its own pump unit. Regarding tests conducted between mechanical force feed and hydrostatic lubricators, they state that they have fitted some engines with hydrostatic lubricators, but prefer the mechanical lubricator.

One road uses graphite lubrication

The talk on lubrication of valves and cylinders so far has had to do with valve oil and of different methods of supplying it to valves and cylinders, but at least one large system has secured some very good results from the use of dry graphite for lubricating valves and cylinders. This graphite is prepared in the form of solidified cakes and is fed by what is known as a pendulum graphite lubricator. The magazine containing the graphite is situated on top of the boiler and back of the smoke-stack. The natural side motion of the locomotive while running causes the pendulum to swing over the cakes of graphite and dusts or scrapes off a small amount of graphite at each swing. The graphite scraped off passes through a pipe into the superheater header and extends to the valves and cylinders.

While the dry method of lubricating valves and cylinders has not been brought into use to any considerable extent, it is nevertheless the opinion of the committee that it offers certain advantages, and we would strongly recommend that this feature of lubrication of valves and cylinders be gone into as thoroughly as possible.

The report was signed by A. N. Boyd, chairman, road foreman of engines, C. N.; W. E. O'Brien, road foreman of engines, B. R. & P.; C. H. Holdredge, district road foreman of engines, S. P.; J. W. Wells, road foreman of engines, N. Y. C. & St. L.; and G. C. Jones, division road foreman, A C. L.

Discussion

The discussion of this report indicated that mechanical lubricators are now being used in considerable numbers on many of the roads and are giving good results. One of the members expressed the sentiment that most of the minor defects common to earlier types of mechanical lubricators have now been remedied and the installation of this device will solve many present lubrication difficulties. On long runs over two or more divisions there is no possibility of the first crew using more than its share of the oil in the lubricator as a certain fixed amount is fed to the valves and cylinders for every revolution of the driving wheels. The lubricator feed is set at the time of shopping the engine and cannot be changed without the authority of the road foreman or master mechanic. It is outside of the control of the engineman except in case of emergency when, to make necessary adjustments, he must break a seal.

A representative of the B. & O. said that mechanical lubricators require little maintenance except the pipes which are subject to breakage by vibration unless the lubricators are properly located with regard to this limitation. Experience seems to indicate that the back valve head is the best place. Discussion at the convention brought out the fact that mechanical lubricants can be used for delivering oil to practically any part of the locomotive, several roads using the various feed lines to air compressor, feed water pump and to the guides. In general, the advisability of a mechanical feed to the air compressor was questioned because the compressor is usually working hardest when the locomotive is still and no oil being delivered. It was testified that to meet this condition at least one of the mechanical lubricators has provision for feeding by hand, there being the objection, however, that operation of the hand wheel forces oil to all the feeds.

The possibility and advisability of setting the lubricator feeds to give ample oil while breaking in a new locomotive was emphasized, the feed later being reduced by proper authority as conditions make it permissible. E. Von Bergen, Illinois Central, said that general experience fails to show whether it is best to lubricate locomotives through the valves or the cylinders, good results have been obtained both ways. He personally believes that a majority of the oil should be delivered to the cylinders, and the Illinois Central practice is to supply 25 per cent to the valves and 75 per cent to the cylinders. Some of the members testified just the reverse, that they delivered 75 per cent to the valves and 25 per cent to the cylinders. One of the members commented on another advantage of the mechanical lubricator in that it permits locomotives to be hauled dead without taking down the rods and blocking the crossheads.

Election of officers and other business

At the concluding session of convention, the following officers were elected for the year 1926: President, J. N. Clark, Southern Pacific; first vice-president, J. B. Hurley, general road foreman of engines and fuel supervisor, Wabash; second vice-president, J. D. Heyburn, master mechanic, St. Louis-San Francisco; third vice-president, James Fahey, traveling engineer, Nashville, Chattanooga & St. Louis; fourth vice-president, Ralph Hammond, traveling engineer, New York, New Haven & Hartford; fifth vice-president, A. N. Boyd, traveling engineer, Canadian National. David Meadows, Michigan Central, was re-elected treasurer of the association. W. O. Thompson, New York Central, is life secretary.

The by-laws of the association were amended to provide for an increase in size of the executive committee from 12 to 18 members, the following new members being elected: J. N. Nicholson, fuel engineer, Atchison, Topeka & Santa Fe; D. R. Sweeney, traveling engineer, Chicago, Burlington & Quincy; A. White, general road foreman of engines, Southern; M. A. Daly, general fuel supervisor, Northern Pacific; W. L. Robinson, superintendent of fuel and locomotive performance, Baltimore & Ohio; J. E. Bjorkholm, assistant superintendent of motive power, Chicago, Milwaukee & St. Paul, and D. I. Bergin, road foreman of engines, Wabash.

As a Means of stopping leaks that develop in containers in transit, the Freight Claim division of the American Railway Association suggests the use of soap. It has been found that soap has been used successfully in garages to stop gasoline leaks, for it does not dissolve in gasoline or heavier oils, melts very slowly in water, and resists some acids.

An effective letter filing system

Method of filing correspondence numerically by classification—Letters located quickly whether referred to in reply or not

By Beno Farenwald
Night enginehouse foreman, Chicago, Milwaukee & St. Paul, Avery, Idaho

THE correspondence filing system described in this article has been used for two years in the office of the master mechanic of the Chicago, Milwaukee & St. Paul at Deer Lodge, Mont., having there demonstrated both its simplicity and effectiveness. The system consists of a classification of correspondence in such a way that each figure in the file number represents a name or classification.

In developing this system it is necessary to have a fairly definite idea of the nature of the correspondence handled and then pick out the most important differences in the correspondence and number them from 1 to 9. In like manner make a second division to represent the second digit and continue until you have enough digits and separations to suit the needs. It is not necessary to assign completely each figure of the classification at first; in fact it is best to assign only figures as there is immediate need for them.

Suppose it is desired to build up a filing system for a railroad mechanical office, with steam and electrical power and all other special equipment under one jurisdiction: The first step is to separate the major differences in the correspondence, possibly numbering steam locomotives (1), electric locomotives (2), gas electric equipment (3), special equipment such as steam shovels, ditchers, etc., (4), power plants (5), roundhouses (6), heavy repair shops (7), labor (8), general, or anything which cannot be classed under any of the above heads (9). The foregoing separations will then represent the first figure in the proposed file number, and in like manner, a second separation can be made as follows: Material (1), machinery (2), lubrication (3), coal (4), fuel oil (5), electric power (6), additions and betterments (7), wrecks (8), general (9). Then for the third set of figures, subdivide into: Reports (1); investigations (2), instructions (3), agreements (4), permits (5), federal laws (6), accidents (7), train delays (8), general (9). The fourth separation might be: Timekeeping (1), pay checks (2), accounting (3), enginemen (4), shopmen (5), other employees (6), discharged employees (7), general (8), unassigned figure (9).

In filing letters the key to the correspondence files would be grouped as shown in Table I, so that a file number can be given each letter quickly, after it has been read by the chief clerk or file clerk.

In addition to the classification in Table I another division which will classify more specifically is the use of a letter on the end of each file, corresponding to the first letter of the most important factor of the letter.

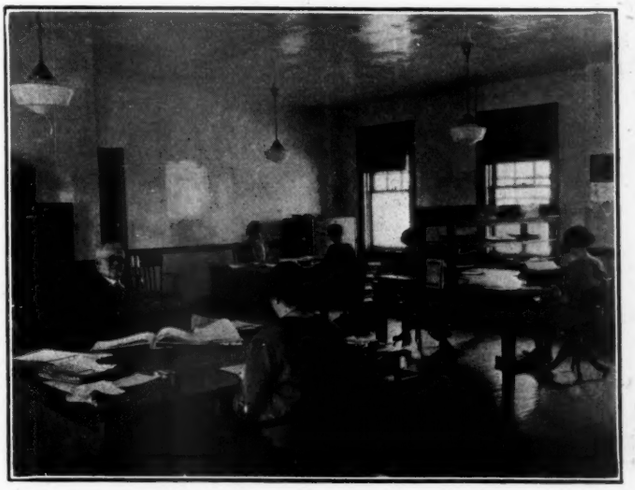
Suppose we now want to file some correspondence in reference to a compressor of an electric locomotive. This would resolve itself into 2298-C. In like manner a letter in reference to a labor agreement would be filed 8948-A. Correspondence in reference to a roundhouse fire would be 6998-F.

Table I

1st Digit of File	2nd Digit of File	3rd Digit of File	4th Digit of File
(1) Steam locomotives	(1) Material	(1) Reports	(1) Timekeeping
(2) Elec. locomotives	(2) Machinery	(2) Investigations	(2) Pay checks
(3) Gas electric equipment	(3) Lubrication	(3) Instructions	(3) Accounting
(4) Special equipment	(4) Coal	(4) Agreements	(4) Enginemen
(5) Power plants	(5) Fuel oil	(5) Permits	(5) Shopmen
(6) Roundhouses	(6) Elec. power	(6) Federal laws	(6) Other employees
(7) Heavy repair shop	(7) Additions and betterments	(7) Accidents	(7) Discharged employees
(8) Labor	(8) Wrecks	(8) Train delays	(8) General
(9) General	(9) General	(9) General	(9) Unassigned

Letter index box or folder also required

The best method of handling this filing system is to make two copies and attach one to the main file, the other being put in a letter index correspondence box or folder corresponding to the first letter of the person the letter is addressed to. A new letter index box should be used every month or as often as necessary. The monthly system generally gives the most satisfaction. The file number should be on each carbon copy as well as on the original letter. The purpose of putting the second copy in the index box is to interlock the files for protection against replying letters giving the wrong file number or not mentioning the file number, but referring to the date of the letter. In this event the procedure would be to go to the box file for the month referred to and under the letter as previously explained find the letter of the date referred to; and obtain from it the proper file number. With this file number in mind go to the main file and obtain the correspondence desired, and pin the entire correspondence together. The file is now ready to be passed to the correspondent. The box index letter should never be taken out of its place unless absolutely necessary as this



The type of filing system in use has an important bearing on office efficiency

is the interlock which protects against replying letters with an incorrect or no file number. If neither date or file number are given, then the correspondence must be classified until the proper file is obtained. This, however, is seldom necessary where a conspicuous red letter stamp at the top of the outgoing letter requests that (In reply please refer to file ——).

Disposition of dead files

After several years of files have accumulated a great many dead files in the filing cabinet can be permanently filed away in the record room. In order to expel dead correspondence from the files it is only necessary to put a hypen between the new file's first and second digit as 1-873-A. Build the new files as previously, and bring the live correspondence over into the new files as it comes up, leaving the remainder in their folders until such time as the live correspondence has been transferred into the new files. The old files can then be filed away in the record room and need only be brought out when something comes up of a very old date.

The disadvantages of this particular system are:

1—The above filing system in rare cases allows two different files to be put away under the same file number. However, there is always a relation between the letters in the same file folder. If files pertaining to each are always kept pinned together no trouble will be experienced.

2—A separate card reference must be kept to trace letters which have not been answered in the time desired.

3—Two copies of each letter must be made, but bearing in mind that it takes no longer to make two copies than it does one, except where the stenographer needs to use an eraser a great many times, the only objection is the exta sheet of paper needed. In view of the fact that very cheap paper can be used for the carbon copies, this is not a serious objection.

The advantages of this system are:

1—The file number can easily be put on the outgoing letters.

2—This system can be installed any time.

3—Obsolete files can be eliminated at any time.

4—Any one can learn to operate the system quickly.

5—This method has an interlocking system which can be operated quickly.

6—This method groups allied correspondence close together.

7—By allowing unassigned numbers vacant new subjects can be assigned numbers.

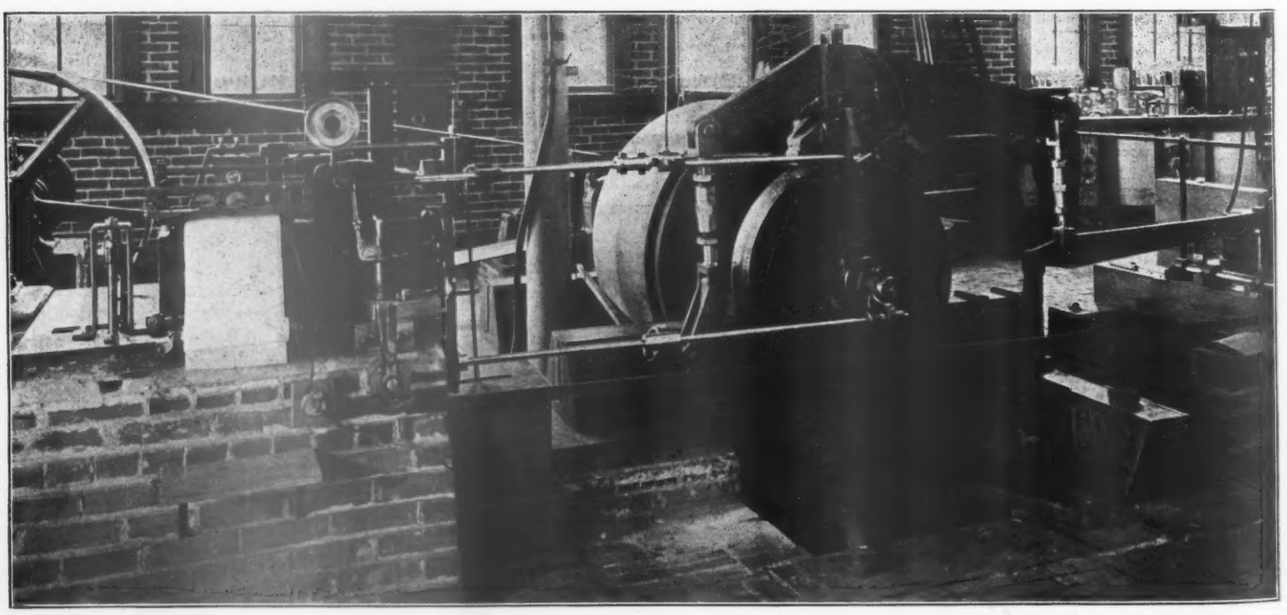
231,088 files are possible

Some idea of the available file numbers can be obtained from a study of the combinations that can be made by four digits of figures whose numbers lie within 9,999 and 1,111 or a sum of 8,888. Then the 26 letters in the alphabet make a possible of 26 times 8,888 or 231,088 possible files.

With 231,088 possible files, the possibilities of such a system can easily be understood. This system can be used by an entire mechanical department. The highest officer in this department need only assign various prefix letters to each subordinate officer. Any file originated by the highest officer will have his prefix, and in like manner files originating from subordinate officers will have theirs.

A mechanical officer whose duties compel him to write letters while traveling can do so by using the classification as a guide, and it will not interfere with his main office, even if he does not classify exactly as his file clerk does in the main office. The only difficulty that this may at times bring about is that the interlock system of ascertaining the file number by classification, which should only be used as a last resort, might not be as efficient. However, this is not a serious objection, and the other advantages gained by being able to file while on a business or inspection trip will more than offset this disadvantage.

This filing system affords an easy method of naming all correspondence quickly; the name is a number which, when referred to by the replying letter, automatically tells where to find the file. In the event that the file number is not referred to, several different quick methods can be applied to ascertain the proper file number.



Brake shoe testing machine installed at Purdue University by the Master Car Builders' Association in 1898

More than 500 brake shoes have been tested for wear and coefficient of friction since its installation. It is available for use at any time for investigation work by the Mechanical Division of the American Railway Association

The locomotive and a test train on the Albany division of the Boston & Albany

2-8-4 locomotive tested on B. & A.

Tests show satisfactory performance of new features of construction—Develops high fuel economy

By F. A. Butler

Superintendent motive power and rolling stock, Boston & Albany

ON page 267 of the May, 1925, issue of the *Railway Mechanical Engineer* there appeared a description of the new 2-8-4 type locomotive which was built by the Lima Locomotive Works, Inc., and placed in service on the Boston & Albany in February, 1925. In this article mention was made of the fact that the locomotive was undergoing tests in service, from which data would later be available. This article contains a summary of the results obtained in those tests.

This locomotive, which was designated as No. 1, was received at the Boston & Albany enginehouse at Selkirk, N. Y., on February 18, 1925. Two days later it was placed in regular freight service on the Albany division of that road and after a short period in regular freight service, test apparatus was applied at the West Springfield shops. The first test trip with the dynamometer car was run on March 28, 1925.

Boiler performance

Test number	Duration of test hrs.	Dry coal per hr.	Dry coal per sq. ft. grate per hr.	Equivalent evap. per hr.	Equivalent evap. per lb. dry coal per hr.	Degree superheat at steam chest	Boiler eff.	Temp. steam in superheater header	Smokebox temp.	Draft front of diaphragm	Draft back of diaphragm	Draft firebox	Pressure at dome	Pressure at steam chest
25-51-10	3.48	5,427	54.27	57,171	10.534	205	72.75	652	569	5.22	3.46	0.67	227	208
25-51-12	3.22	4,871	48.71	54,273	11.140	194	78.49	650	571	5.43	3.58	0.76	224	209
25-51-14	3.33	4,112	41.12	49,203	11.966	190	83.63	637	543	3.90	2.61	0.70	227	195
25-51-16	3.13	4,730	47.30	53,729	11.360	195	81.66	639	556	4.44	2.38	0.83	226	202
25-51-18	2.82	4,957	49.57	61,729	12.452	216	89.51	660	577	4.63	3.24	0.78	224	204
25-51-20	2.87	5,420	54.20	65,343	12.034	213	87.84	663	562	5.30	4.05	0.90	231	211
25-51-22	2.95	6,423	64.23	69,320	10.790	236	75.25	672	599	6.70	4.83	1.04	231	211
25-51-24	2.83	5,597	55.97	63,111	11.277	220	77.86	665	585	5.15	3.42	0.69	224	203
25-51-26	3.46	5,856	58.56	63,333	10.816	210	77.60	659	582	5.59	3.82	0.69	216	201
Average	3.12	5,266	52.66	60,690	11.370	209	80.5	655	571	5.15	3.49	0.78	225	205

Test equipment

The test equipment included New York Central dynamometer car No. X-8006. Indicators were placed on the cylinders of the locomotive and gage glasses were applied to the corners of the tank to measure the water. The tank was calibrated by weighing water in a barrel mounted on platform scales on top of the tank. A slope bottom coal box mounted on platform scales was applied to the tender for measuring coal.

Steam gages were applied at the dome, to the saturated side of the superheater header, to the superheated side of the superheater header, to the steam chest, to the exhaust passage, to the steam space of the feed water heater, to the feed water line at the boiler check, to the steam line to and to the exhaust line from the locomotive booster.

Thermometers were applied to both steam pipes close to the steam chest and to the exhaust passage on the left side. Thermometers were also applied in the tender tank, in the water line to the feedwater heater, in the water line from the feedwater heater, in the exhaust steam line to the feedwater heater and in the condensate line from the feedwater heater. Pyrometers were applied to the superheated side of the superheater header and in the smoke box.

Provision was made to read the draft in the firebox,

in front of and in back of the diaphragm. A summary of the data collected is given in the tables.

Operating conditions

The Albany division is between Selkirk, N. Y., and Springfield, Mass., a distance of approximately 100 miles. The tests were run east bound from Selkirk to Washington, which is at the top of the grade, a distance of 60 miles. A condensed profile of the line is included which also contains certain operating data as well as the profile. The Albany division has many curves, but no attempt has been made to show these on the condensed profile.

Under normal conditions the volume of freight and passenger traffic closely approaches the capacity of the track. Therefore, any increase which can be effected in the size of the train unit and the speed of operation relieves this condition.

Nine reliable tests were made between March 28 and April 18. During this period the weather conditions were variable and at times the condition of the rail was poor, as light snows were encountered. The average atmospheric temperature for one complete test was 43 deg. F. The tests were run under normal operating conditions and the results, therefore, reflect the performance of the locomotive in regular service.

All figures are given as average over the test division including the effect of all variations of power output, from the maximum to the minimum which go to make up the average, and hence are valuable as data which can be used to make comparisons and predictions in regular train operation. For this reason no attempt was made to correct for grades and curves where these factors might enter into the final results.

Average boiler and engine performance

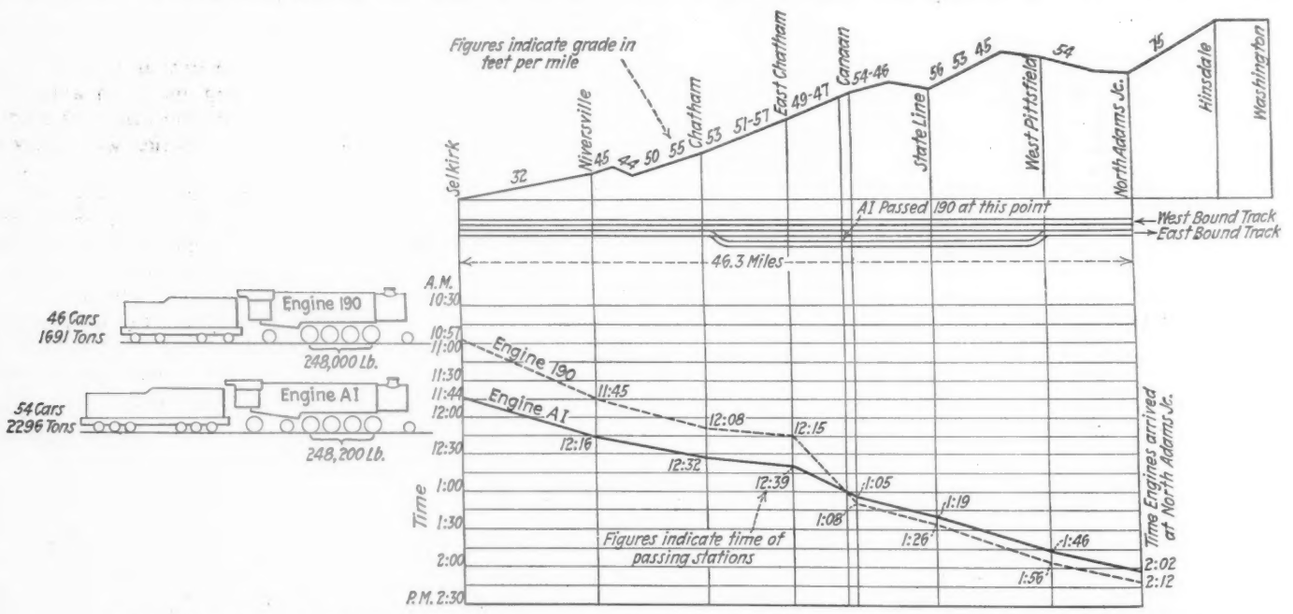
The efficiency of the steam generating plant ran from 72.75 per cent to 89.51 per cent, the average of all runs being 80.5 per cent. The relation between coal rate and efficiency is shown in one of the diagrams. This high average was the direct result of the large grate area and firebox and the boiler equipment. The large grate area gave an average coal rate per square foot per hour of 52.66 lb. for all runs. The large firebox and the Type E superheater which permitted a maximum gas area through the tubes and flues, together with the feedwater heater produced an average evaporation of 8.13 lb. of water per lb. of coal as fired. The equivalent evaporation per lb. of dry coal was 11.37 lb., average.

The smoke box temperatures clearly reflect the ability of the firebox and boiler to absorb heat. These figures ran from 543 deg. F. to 599 deg. F.

The boiler pressure of 240 lb. per sq. in. and the limited cut-off enabled this engine to produce an average of 1923.7 indicated horsepower with an average cut-off over the test division of 43.7 per cent. This resulted in an average water rate per indicated horsepower-hour of 20.16 lb. The coal per indicated horsepower-hour was 2.44 lb., average, with a maximum of 2.67 lb. and a minimum of 2.34 lb. The maximum cylinder horsepower recorded was 3,675.

Engine performance

Test number	Ave. working speed	Ave. cut-off, per cent stroke	Ave. I. hp.	Dry coal per I. hp. per hr. inc. auxil.	Dry coal per I. hp. per hr., exc. auxil.	Steam per I. hp. per hr., inc. auxil.	Steam per I. hp. per hr., exc. auxil.	Ave. drawbar pull	Ave. dynamometer hp.	Dry coal per d. hp. per hr., inc. aux.	Dry coal per d. hp. per hr., exc. aux.	Steam per d. hp. per hr., inc. aux.	Steam per d. hp. per hr., exc. aux.	Machine eff. of locomotive	Thermal eff. of locomotive
25-51-10	13.25	46.0	1,795.5	3.02	2.67	23.46	20.58	35,350	1,399.7	3.88	3.41	30.10	26.41	82.4	4.67
25-51-12	15.76	41.5	1,835.4	2.66	2.36	21.87	19.41	31,150	1,310.8	3.71	3.30	30.64	27.18	79.7	4.98
25-51-14	14.42	35.2	1,706.0	2.68	2.37	21.42	18.60	29,500	1,179.1	3.49	3.03	30.99	26.90	77.4	5.07
25-51-16	15.63	41.0	1,763.5	2.68	2.37	22.64	19.94	32,450	1,354.2	3.50	3.08	29.48	25.97	79.7	5.39
25-51-18	18.18	39.5	1,826.9	2.71	2.34	24.91	21.55	31,216	1,515.2	3.27	2.83	30.04	25.98	82.9	5.77
25-51-20	17.62	45.0	2,007.1	2.71	2.41	23.98	21.38	36,000	1,693.6	3.20	2.86	28.41	25.33	83.2	5.99
25-51-22	16.84	48.5	2,367.8	2.72	2.41	21.47	19.09	38,067	1,711.6	3.75	3.34	29.70	26.40	80.6	4.88
25-51-24	18.03	43.0	2,077.3	2.69	2.42	22.38	20.06	33,300	1,603.1	3.49	3.13	29.00	25.99	79.2	5.19
25-51-26	14.79	54.0	1,934.9	3.03	2.62	24.12	20.85	39,650	1,565.8	3.74	3.23	29.80	25.76	83.4	5.03
Average	16.16	43.7	1,923.7	2.76	2.44	22.92	20.16	34,076	1,481.4	3.56	3.13	29.72	26.21	80.2	5.22



Profile of the Albany Division, showing the comparative test run of locomotive No. 1 and a Mikado locomotive

The dry coal per dynamometer horsepower-hour averaged 3.13 lb., with a maximum of 3.41 lb. and a minimum of 2.83 lb. The maximum drawbar pull was 76,800 lb., of which the booster produced 11,800 lb. The maximum sustained drawbar horsepower recorded was 3,240.

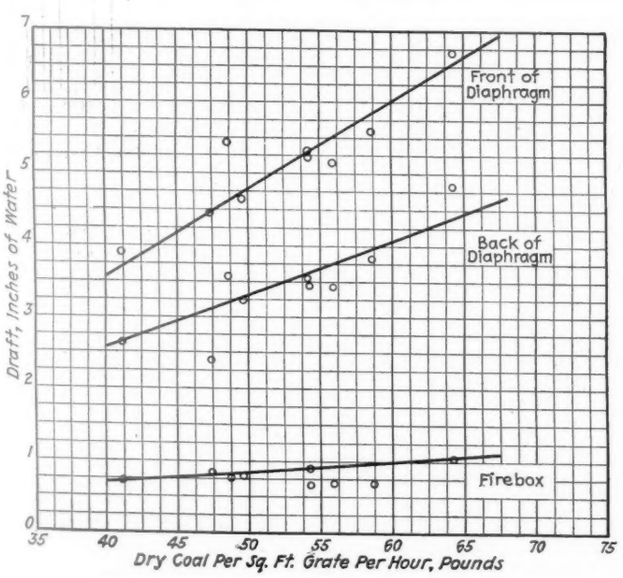
The locomotive as an operating unit

Reference was made in a previous paragraph of this article to the severe operating conditions on this division

The relation between boiler output and coal consumption

due to the great number of trains to be moved and the relief it is possible to obtain by increasing the size of the train unit and the speed of operation. To effect this requires an increase in gross ton-miles per hour per locomotive, which in turn means a corresponding increase in dynamometer horsepower per locomotive.

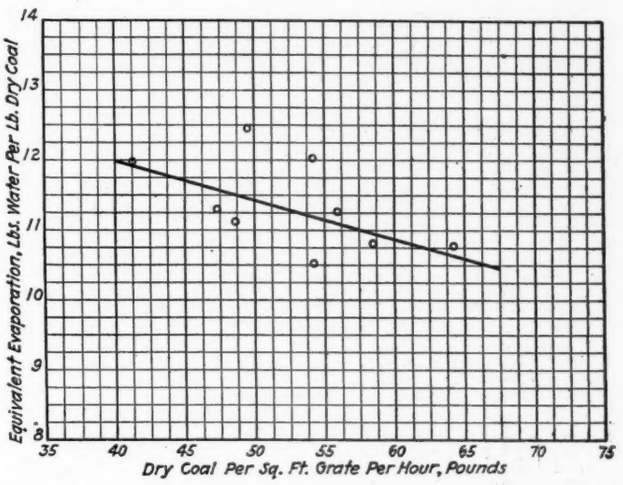
Probably the clearest comparison in this regard between the 2-8-4 type engine and the Mikado type now used on the Albany division (the principal dimensions



Variation of the coal rate in relation to the draft

of which were compared with those of the 2-8-4 locomotive in the description of the latter in the May, 1925, *Railway Mechanical Engineer*, was the test run of April 14, 1925. This comparison is shown in the diagram below the drawing of the profile of the division.

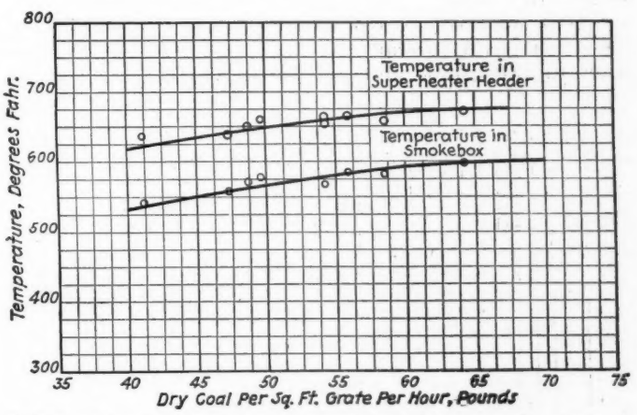
On this day Mikado engine No. 190 started from Selkirk with a manifest train of 46 cars, 1,691 tons, 47 minutes ahead of the 2-8-4 type class A-1 which had 54 cars, 2,296 tons. Both trains ran without delays, the A-1 overtaking the No. 190 at the point shown on the diagram. At Chatham, No. 190 took the outside track so that at the time of passing the two trains were running side by side on parallel tracks under exactly the same conditions. Between East Chatham and Canaan is a difficult part of the line, with many curves and a heavy



The relation between the coal rate and the rate of evaporation

grade, the severity of this part of the line in comparison with other sections having similar average grade conditions not being adequately shown by the profile.

This run may be taken as a fair comparison of the relative ability of the two engines to move freight over the line. The uniform speed of the 2-8-4 type locomotive over the test division is noteworthy as indicated by the uniform slope of the time curve.



Relation between the coal rate and superheater and smokebox temperatures

The following data compiled from the test result of the two locomotives is a comparison on the basis of gross ton-miles and fuel.

Average dynamometer horsepower, which is proportional to gross ton-miles per hour

Average lb. dry coal fired per hour	A-1	Mikado	Per cent increase A-1 over Mikado
4,000	1,200	†	...
4,500	1,350	†	...
5,000	1,480	1,200	23.5
5,500	1,600	1,250	28
6,000	1,750	1,320	33
6,500	*	1,420	...
7,000	*	1,550	...
7,200	*	1,650	...

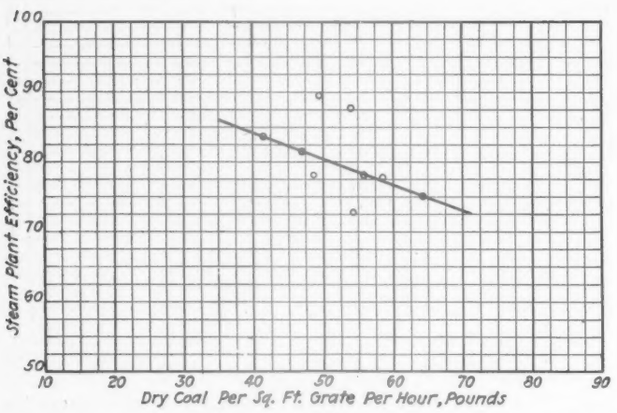
*The A-1 never reached these rates of firing.
†The Mikado never ran at as low rates as these during the tests.

Further details of the test data are shown in the tables

of engine and boiler performance. Charts showing a number of pertinent relationships with respect to the coal rate per sq. ft. of grate per hour, the coal and steam consumption rates and the thermal efficiency, calculated from this data, are also presented.

Performance of the new features of construction

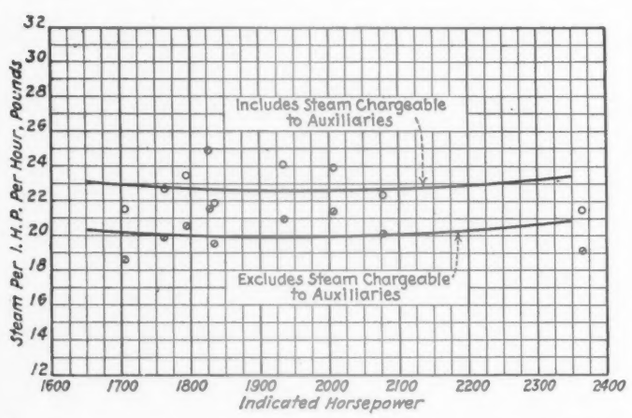
Many new features of construction were incorporated into the design of the Class A-1 locomotive. As these are vital elements in the economic performance of the



The efficiency of steam generation in relation to the coal rate

engine, their operation was noted with special care to determine their adaptability and usefulness under service condition. The principal new features, which were described in detail in the May, 1925, issue of the *Railway Mechanical Engineer* are the compensated limited cut-off in the cylinders, the cast steel cylinders, the articulated main rod drive, the articulated trailing truck and the large grate area.

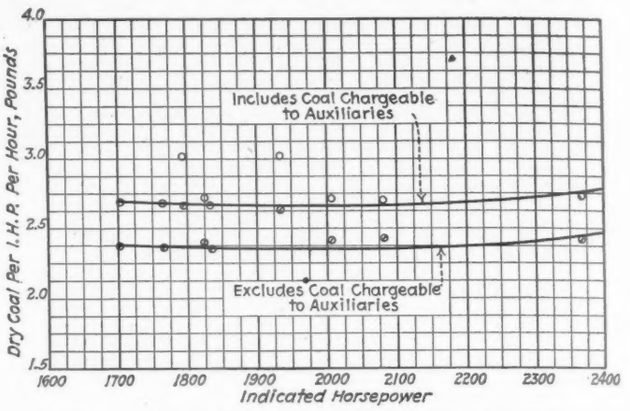
Trials were run to determine the best point of cut-off consistent with prompt starting under the worst conditions of rail, grade and position of the cranks. It was



Steam consumption in relation to indicated horsepower output

found that 60 per cent maximum cut-off best met this condition. With this cut-off an indicated tractive force of 69,400 lb. was obtained at slow speeds. The indicator cards gave a very even turning moment with the result that with this tractive force, giving a factor of adhesion of 3.58, there was no more tendency to slip than there would be with a full stroke cut-off engine, having the same driving wheel load and developing 63,500 lb. tractive force. Prompt starting was secured under all conditions.

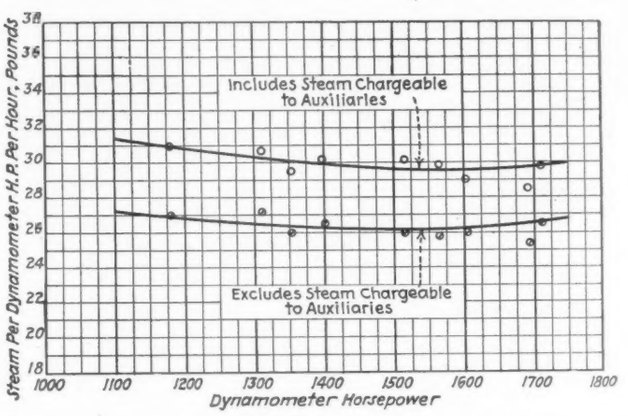
With respect to the cylinders, the only comment which can be made after a limited time of operation of about three months is that the cylinders showed no signs of



Dry coal consumption per indicated horsepower

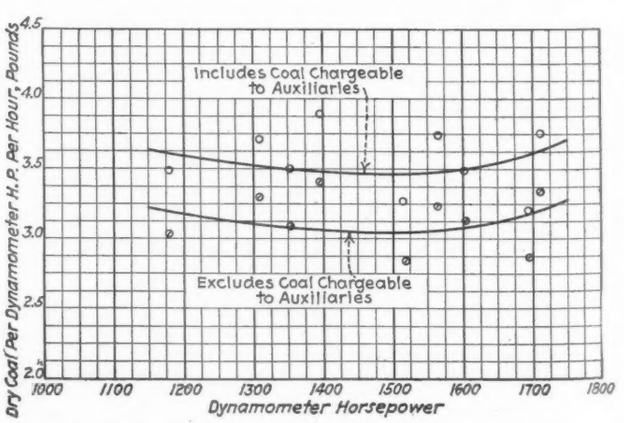
weakness and that all the joints of the exhaust passages remained tight. In fact these joints were never touched during that time.

No trouble was developed with the new type of rod



Steam consumption in relation to dynamometer horsepower output

drive, the same bearings with which the rods were first equipped remaining in place throughout the test. No hot pins or main boxes trouble developed, although with

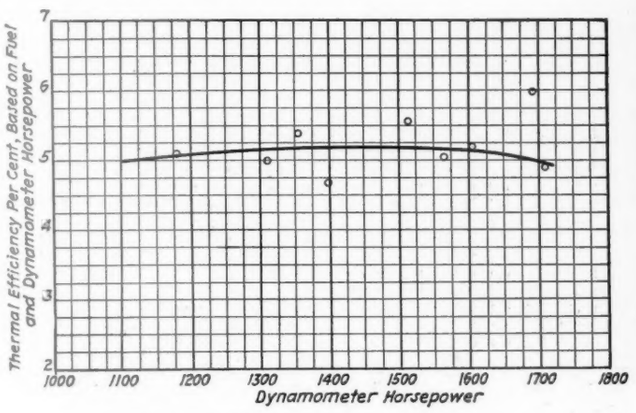


How the rate of coal consumption varied with the dynamometer horsepower output

240 lb. pressure the piston thrust is 148,000 lb. Measurements of the wear on the main and rear boxes were made to determine whether the piston thrust was being dis-

tributed by the rod drive over two pairs of boxes. These measurements showed almost exactly the same horizontal wear in the back as in the main brass thus indicating the correctness of the theory that this rod drive distributes the thrust over two pairs of wheels. Final confirmation of this, however, can only be obtained after more extended service.

No trouble of any kind was experienced with the tracking or operation of the articulated trailing truck and it seemed to adapt itself very well to the track conditions. The engine rode steadily up to the highest operating speeds which the service required. Particular comment



The thermal efficiency at the drawbar

is made upon the large ash pan and the ease with which it can be dumped. The accessibility of the booster and stoker is also worthy of note from a repair and maintenance standpoint.

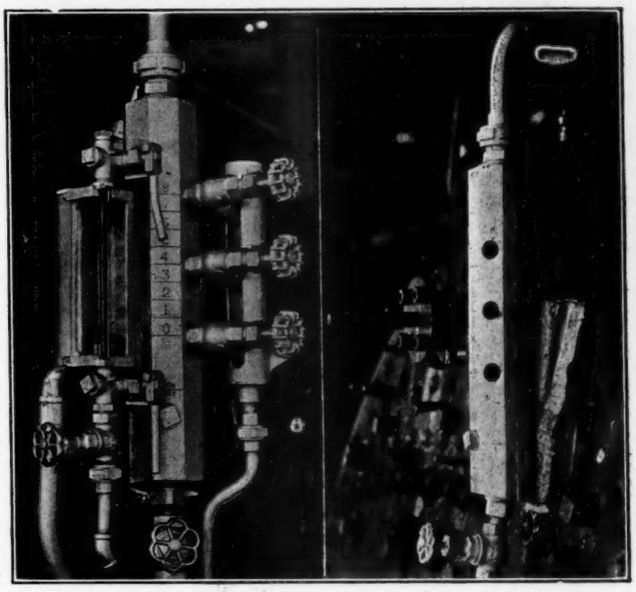
Observations were made to determine if under conditions of very light work proper combustion would be supported over the large grate area. No trouble from this cause was experienced and rates of firing as low as an average of 41 lb. of coal per sq. ft. of grate per hour over the test division were recorded.

Compact cast steel water column

IN view of the interest being shown by the railroad field in the question of satisfactory water columns, the accompanying details of the L. & C. cast steel water column, which has become standard on the Canadian National, should offer useful suggestions to those working on this problem. Up to the present time over 300 locomotives have been equipped with this column. It is of a compact and rigid design and is welded directly to the backhead of a boiler without the use of separate brackets. This method keeps the application close enough to the face plate to give the engineer an unobstructed view of all gages. This condition, together with the elimination of bolts or studs for securing it to the boiler, is a particular feature of the L. & C. column. The welding pad which is cast integrally with the column permits over 30 in. of welding and this pad is so designed as to fit on to a locomotive boiler without covering any tee-iron rivets.

The first L. & C. columns applied had a bore of 2 in., but later applications were given a 3-in. diameter bore. The bottom connection into the boiler, which is made of cold-rolled brass, is provided with a ¾-in. opening and is applied in such a manner as to provide additional fastening to the boiler. By removing the plug in the face of the column, the bottom connection can be readily cleaned.

The water glass mountings are applied directly into the column in such a position that they project the least possible distance beyond its face while still being easily



General view of water column and method of welding to backhead

visible to both the engineman and fireman. In the case of the Canadian National mountings, they project only 2½ in. beyond the face of the column.

FREE AND EASY.—The following account of an accident caused by an explosion in an empty tank car, published in Bulletin No. 67, Bureau of Explosives, is pointed in its lesson, as well as in its style:

"Because of a shortage of space, this one had to be left out of the preceding bulletin, but really, it is too good to miss. If your own ears burn when you read it, please note that no names have been mentioned, and gratefully accept the opportunity to turn over a new leaf.

"A freight train stopped somewhere along the line. In the train was an empty tank car which had previously contained gasoline. A couple of tramps came along, looking for free transportation to some region where handouts were freer and bulldogs more scarce. As a rule, a freight brakeman loves a tramp to about the same degree that a dog adores a cat; but in this particular instance the flag-bearer must have recognized a personal friend or something, for he cast about for a place wherein the brake-beam acrobats might ride without being detected.

"Aha! the empty tank car! Realizing that there might be vapors in the car even stronger than certain characteristics of the average tramp, the brakeman took the most dependable, as well as the most sudden, way of finding out. In other words, he lowered his lighted lantern through the dome!

"It really seems superfluous to go on. Our sentiments concerning the whole affair are most forcefully (though unintentionally) expressed by a paragraph from the B. E. Form 25, on which the case was reported. This paragraph is as follows, the numbers referring to numbered questions on the form:

"1—Blank! 2—Blank!

"3—Brakeman was inspecting interior of empty tank car to see if O. K. for trespassers to ride in it. As he lowered his lantern into the dome, gas explosion occurred, severely burning the brakeman and a trespasser about the head, neck, hands and arms. Brakeman will be incapacitated for a period of about three weeks.

"4—Blank. 5—Blank!

"The exclamation points are our own. The thought occurs that if the brakeman was burned about the head, possibly some charcoal was formed."

Safety first competition

By H. L. Needham
Master mechanic, Illinois Central, Clinton, Ill.

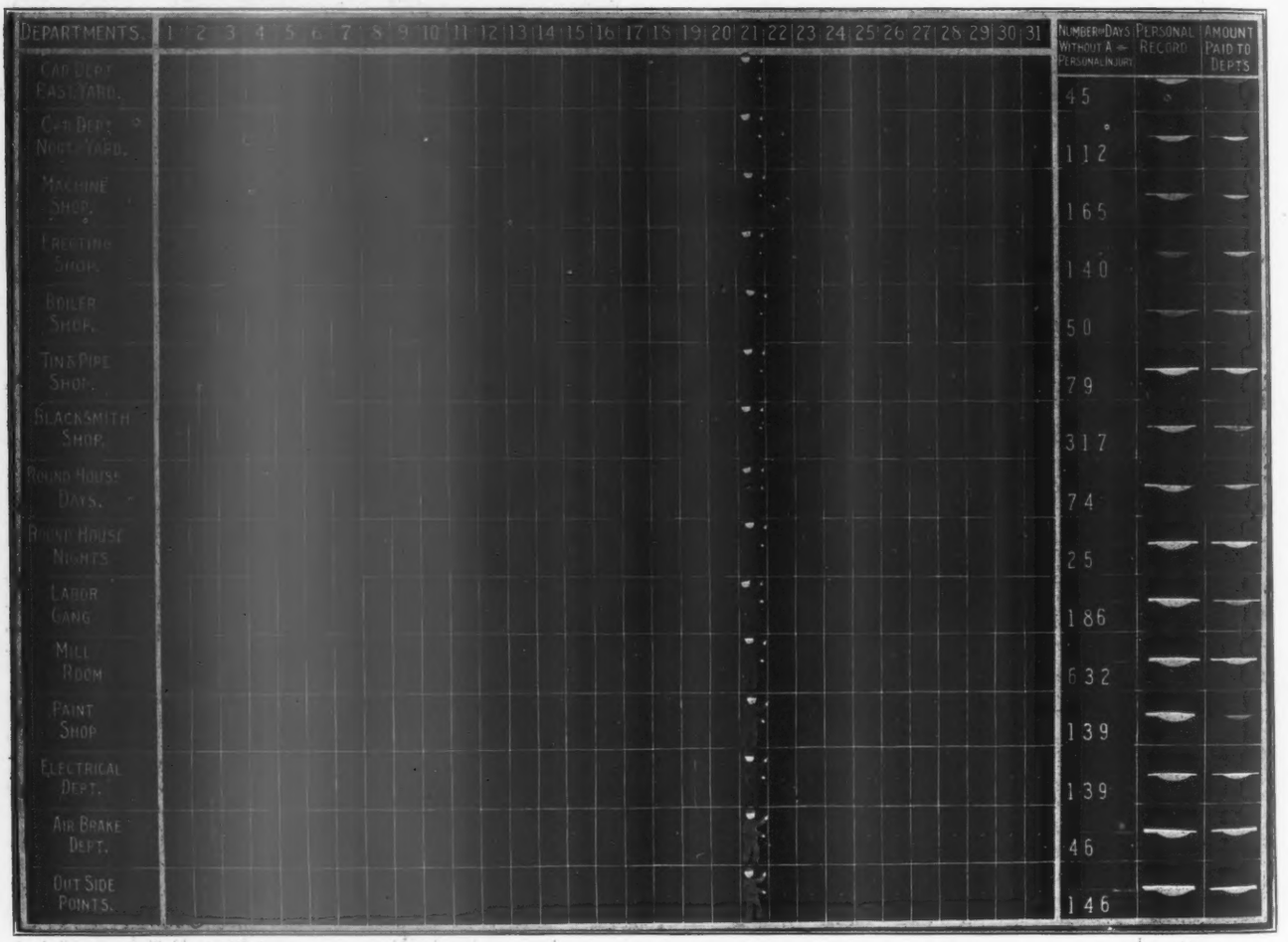
COMPETITION in safety first records is encouraged in the Clinton shops of the Illinois Central by means of the 63-in. by 90-in. board illustrated. At the top of the board the days of the month are indicated and at the left the various departments in the back shop, enginehouse and car repair yards. On the right of the board are three columns, one of which indicates the number of days which have elapsed without a personal injury and the other two containing pockets for personal record cards and cards indicating the amount of money paid to injured men.

About 700 shopmen are employed in 15 different departments, each of which is represented by the figure of a man which may be moved about on the board at will. Should a personal injury occur in one of the departments the figure is left standing at the date when the injury occurred, the name of the man being written on a small T-card and attached to the figure by a flap which slips in a pocket provided for this purpose. The figure remains on that date until the close of the month, an additional figure being started in its place. Should a second man be injured in that department the second figure is left on the date on which the injury occurred, and in this way at the end of a month there are as many figures on the board for each department as there have been accidents in the respective departments.

The use of this board keeps before the supervisory officers the names of the men who are injured, the department in which each works, the number of days which have elapsed without a personal injury, together with the amount paid in compensation. Healthy competition between the departments is stimulated.

The board illustrated was put in use May 1, 1925. During the month of May, 1924, 11 injuries were reported in the mechanical department at Clinton, there being none in May, 1925. In June, 1924, 11 injuries were again reported, there being two in June, 1925. A similar improvement was made in July. In other words, and four injuries during a similar period in 1925.

Much interest has been shown in the matter of safety since this arrangement for visualizing results was put into effect. Each department endeavors in every way to keep from having an accident which will spoil the record of "number of days without a personal injury." Moreover, the employees do not want their names to appear on this board and consequently do everything in their power to prevent getting injured.



Safety first board used at Illinois Central shops, Clinton, Ohio

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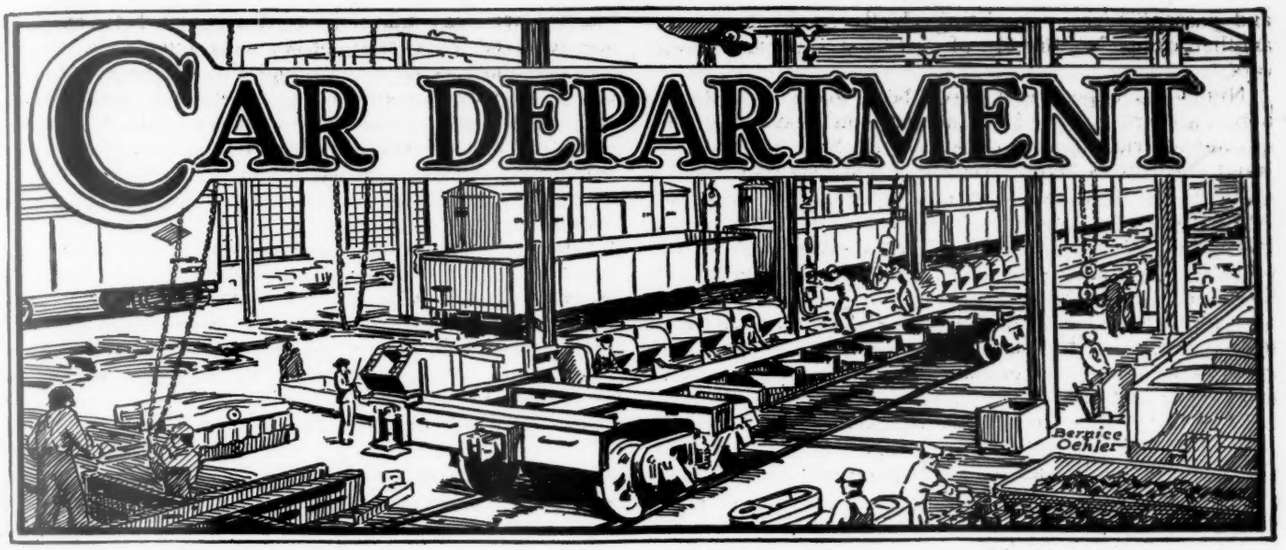
A SECOND WASTE RENOVATOR and oil reclaiming machine has been installed at its shops at River Rouge, Detroit, by the Detroit, Toledo & Ironton, and is reclaiming an average of 80 gal. of refined oil and 260 lb. of clean waste daily. The operation has been simplified to such an extent that the cost has been reduced considerably below the value of the oil and waste reclaimed.



Car inspectors and foremen hold twenty-fourth convention

Opening sessions featured by papers on lubrication and progressive freight car repairs

THE twenty-fourth annual convention of the Chief Interchange Car Inspectors' and Car Foremen's Association of America was held at the Hotel Sherman, Chicago, September 22, 23 and 24. The sessions were presided over by President C. M. Hitch, a total of 549 members and guests being registered in attendance at the convention. Short informal addresses were delivered by F. H. Hammill, executive vice-president of the Chicago, Rock Island & Pacific, and F. W. Brazier, assistant to the general superintendent of rolling stock, New York Central. Among the individual papers presented were Progressive System of Freight Car Repairs, by F. A. Starr, general car inspector of the Chesapeake & Ohio; Lubrication, by L. R. Christy, general car inspector of the Missouri Pacific; A. R. A. Billing and Preparation of Records, by L. Martin, chief accountant, A. R. A. Bureau, Baltimore & Ohio, and Prevention of Transfers and Transfer Claims, by F. S. Cheadle, chief car inspector, Richmond, Fredericksburg & Potomac. Abstracts of these addresses and the convention proceedings will be published in this and succeeding issues of the *Railway Mechanical Engineer*.

New officers elected

The following officers were elected for the ensuing year: President, W. P. Elliott, general foreman, Terminal Railroad Association of St. Louis, East St. Louis, Ill.; first vice-president, B. F. Jamison, special traveling auditor, Southern, Meridian, Miss.; second vice-president, E. R. Campbell, general car foreman, Minnesota Transfer, St. Paul, Minn.; third vice-president, M. E. Fitzgerald, general car inspector, Chicago & Eastern Illinois, Danville, Ill.; secretary and treasurer, A. S. Sternberg, master car builder, Belt Railway of Chicago, Chicago. The following were elected members of the executive committee to serve two-year terms: F. A. Starr, general car inspector, Chesapeake & Ohio, Covington, Ky.; L. R. Christy, general car inspector, Missouri Pacific, St. Louis, Mo.; and W. R. Rogers, chief interchange inspector, Youngstown, Ohio.

Lubrication

By L. R. Christy

General car inspector, Missouri Pacific, St. Louis, Mo.

The problem of bearing lubrication is the oldest of all lubricating questions. As we review its development since man first conceived the idea of vehicular movement with bearing surfaces, we find that innumerable improvements have been made in the designs of journals and bearings, the refining of lubricants and methods pursued to insure correct practice. It is obvious that the future will unfold further advantages over our existing standards of lubrication.

Selection of materials

In the purchase of waste, it is essential that the material be free from rags, knotted fibre, particles of metal, grit and other foreign substances, and that the strands be of sufficient lengths. To insure this, the waste should be bought on specifications sufficiently rigid to permit of rejection of material which does not meet these requirements. The waste must have properties that give the necessary degree of resiliency to insure proper contact with the journal at all times, and be capable of conveying the oil to the journal with sufficient rapidity to maintain the lubricating film without breakage. There seems to be a fairly unanimous agreement that the two standard types of waste are preferable: one for use on locomotives

and passenger cars, consisting chiefly of wool strands; another composed entirely of cotton strands for freight cars.

Numerous experiments have been made in order to obtain a bearing metal formula that would cause the least amount of friction, and yet be sufficiently strong to withstand pressure without crushing. Our standard lining metal is a tri-metal alloy, consisting of 85 per cent lead, 10 per cent antimony and 5 per cent tin. This closely follows the recognized standards of a great many of the principal railroads, and is a satisfactory formula. A lining metal of this kind, due to the greater proportion of lead in the formula, will, within a short time, conform to the contour of the journal and reduce the unit pressure to a minimum. In the purchase of new journal bearings, and where old journal bearings are relined by outside companies, it is advantageous to have the test departments of the railroads make periodical inspections at such plants to determine whether proper compositions are used.

We can ill afford to discuss the subject of lubrication without considering the laws of friction, as it is apparent that, were there no friction, there would be no necessity for interposing a lubricant between the journal and journal bearing. The primary object of bearing lubrication is to provide a lubricating film between the rubbing surfaces, and thereby replace the metallic friction with fluid friction, so far as possible, and then, to minimize the fluid friction in the oil itself. Fluid friction is independent of the pressure of the surfaces in contact, but is directly proportional to the area of the rubbing surfaces. If we will give but a moment's thought to this statement, we will realize that it is true, because, each infinitesimal particle of oil will retard the movement of the entire body of oil, and, as the viscosity of the oil increases, so will the fluid friction. Compare the flow of oil from a receptacle, first using a light car oil and then a heavy valve oil. The light car oil will flow from the receptacle more readily because its fluid friction is lower than that of the valve oil. It must be remembered, however, that, as the temperature of the bearing increases, the viscosity of the oil decreases, and the body of the oil must be such that it will maintain the film without breakage at the normal running temperature of the journal. Experiments conducted to determine the relative temperature of the journal, the bearing and the lubricant have indicated that the temperature of the lubricating film is higher than that of either the journal or the bearing. It therefore follows that the least viscous lubricant not unduly influenced by great variations in temperature is the most desirable car oil. The oils which best satisfy these requirements are mixtures of mineral oil and suitable fixed oils.

Renovation and saturation of packing

The company with which I am connected, arranged during the current year for the installation of waste renovating plants of modern design at two of its principal shops. All journal packing removed from locomotives, passenger cars and freight cars, in addition to waste used in shops, is forwarded to these plants for renovation. The journal packing thus reclaimed is also re-impregnated at these plants, as is the saturation of new packing, and this material completely prepared for immediate use, is apportioned to the various shops, repair and inspection points, as needed. It seems to the writer to be of sufficient interest and probably value to relate the process as it obtains and the results achieved in this manner.

The packing removed from journal boxes, and the discarded waste in shops is placed in specially constructed metal containers, of approximately 300 lb. capacity, and bearing necessary markings to distinguish between packing removed from locomotives, passenger cars, freight cars and shop waste. As promptly as sufficient quantities are accumulated at any point, shipment is made to the nearest renovating plant. These same containers are used, of course, in forwarding packing to the various locations, and in this manner sufficient containers are always available at both the plants and the outlying points on the railroad.

When consignments are received at the plant, the contents of each container are weighed, inasmuch as a complete record is kept of the material received and issued to each point, which affords a positive method of determining whether or not all old material is returned.

The waste is first placed in metal trays, where the larger pieces of babbitt, cinders, small stones and other similar foreign substance are removed. This requires only a few minutes to each container of packing. The next operation consists of placing the waste in a heating tank, where it remains approximately 20 min. immersed in oil, at a temperature of 130 to 140 deg. F. It is then forked up on a drain board and drained for a period of from three to five minutes. Then, the waste is removed to a motor driven centrifugal extractor, which is equipped with a filtering arrangement, and rotated for five minutes at the rate of approximately 1,200 r.p.m. At this stage of the process most of the oil has been removed, filtered and drained into an underground storage tank. After this operation, the waste is conveyed to a motor driven cleaning and drying machine, where the dirt is thoroughly removed from the material, and it is dried within 12 min. This machine is equipped with steam coils and air intake fan and operates under air blast at a temperature of 180 deg. F. The cylindrical container oscillates after making two and one-half revolutions in either direction. When the waste is removed from this machine, it has been thoroughly renovated and is ready for saturation in the waste impregnator. This device, by the combined use of a vacuum pump and compression head, actually accomplishes the complete saturation of the waste in less than five min. In preparing packing from the renovated waste, only the reclaimed, filtered oil is used, which is pumped from the underground storage tank to the impregnator. Past experience has shown that one gallon of surplus oil accrues to each 100 lb. of waste renovated. In other words, slightly more oil is recovered from this amount of renovated waste than is consumed when it is again saturated. It has been demonstrated that oil does not wear out in service, but simply becomes contaminated with foreign matter, and after proper reclamation is, in reality, as good as new oil. New oil is used with new waste in preparing new packing. In no case is new packing mixed with renovated packing.

An electrically operated machine for making packing rolls is also contained in this system.

The capacity of each plant is two and one-half million pounds of renovated packing per annum, which reduced to an average daily production, amounts to 9,000 lb. The services of five men are required in connection with the operation of each plant.

This system has many varied advantages over the ordinary methods of reclaiming and saturating packing. You have perceived that the entire operation of renovating and saturating the packing requires less than one hour, as compared with 48 hours, which is the usual length of time waste is subjected to immersion, not to mention the labor incident to cleaning waste by hand. Without doubt, the packing is decidedly cleaner and the oil penetration is better. By concentrating this work into fewer plants of greater capacity, and modern design, a large number of small obsolescent plants were abandoned.

Aside from the improved mechanical features mentioned, this concentration alone insures both economy and uniformity of practice. With both, a substantial saving is possible, owing to the greater percentage of oil and waste reclaimed, including the used shop waste converted into freight car packing, and a corresponding decrease in new oil and waste issued. Moreover, the extravagant use of materials is minimized, if not entirely eliminated, by this procedure. Wasteful practices are more difficult to correct where the packing is prepared at numerous points, as it is evident packing indiscriminately made is not always properly drained, nor is all old packing accounted for, as it is often left in train yards, thrown in outbound cars, used in firing locomotives, or otherwise discarded, unless there is some definite means to keep a record of the consumption. This process also largely precludes the use of free oil which is such an expensive factor in lubrication.

Considerable discussion has ensued at these meetings with respect to conditions contributing to hot boxes, as well as the proper method of packing boxes. It follows that the causes are generally understood, and doubtless there is but a slight divergence of opinion concerning the packing of boxes, which is largely restricted to the advisability of applying a filler, or plug, at the front of the journal box. Reasoning on this basis, it is apparent we should then determine whether the correct practices are followed. Have we assured ourselves that inspection forces are sufficiently alert in their efforts to discern the various defects that result in hot boxes? Are we certain that oiling forces in train yards are giving necessary service treatment to cars, and that sufficient dexterity is shown with the packing iron?

Considering the importance of the proper use of the packing iron, it is surprising how frequently this attention is neglected. I am inclined to believe that few railroads have standard packing irons and packing hooks, as is evidenced by the miscellaneous assortment in use. Many of these are of such dimensions and construction as to prevent oilers from obtaining best results. A satisfactory means of fixing individual responsibility for improperly packed boxes, is to assign to each oiler a symbol number, with alphabetical prefix to designate terminal or division, and require him to mark this symbol on both sides of car when he has given service treatment, or repacked boxes. If trouble subsequently develops at any point on the railroad, due to improper attention, it is possible definitely to place responsibility with the oiler at fault.

It is conceded that cars ordinarily do not remain in train yards for a period sufficient to make a thorough inspection of packing in all boxes, and to completely adjust packing, or repack boxes when necessary. In view of this condition, it behooves us to give thorough attention to cars when on repair tracks where facilities are available. In such instances, the packing should be entirely removed and each box repacked at designated intervals. The necessity of complying with this practice cannot be too forcibly emphasized, and if each railroad will actively pursue a program of this kind, an appreciable reduction in the number of hot boxes will be made. During the time the car is on the repair tracks, reasonable precautionary measures should be taken with respect to the mechanical conditions that contribute to hot boxes. Trucks should be in proper alinement; journal boxes parallel and not unduly worn; tops of boxes free from irregular surfaces, dirt and grit; broken or missing truck springs should be replaced; wedges should not be distorted or otherwise defective. When wheels are exchanged, compound should be thoroughly removed from journals and journal boxes carefully cleaned. Due care should also be exercised in removing worn truck pedestals on passenger cars. The best results are not obtainable when relined journal bearings are used on passenger cars. The periodical jacking of boxes on passenger cars, for the purposes of carefully examining journal bearings, wedges and journals, is advisable and necessary to the successful operation of passenger trains. Our practice is to inspect each passenger car in this manner at three months' intervals. The expense thus incurred is promptly offset by the reduction in cost of caring for hot boxes.

Before concluding, I desire to comment briefly on the intimate relation of supervision to the suppression of hot boxes. Intensive supervision is always a potent factor in this respect, just as it is in connection with various other phases of our work. A single illustration of its significance is that hot box trouble does not long remain in epidemic form at any one point.

C. M. Hitch (B. & O.)
President

W. P. Elliott (Terminal R. R. Assn.)
1st vice-president

B. F. Jamison (Southern)
2nd vice-president

A. S. Sternberg (Belt Ry. Chicago)
Secretary

Progressive system of freight car repairs

By F. A. Starr

General car inspector, Chesapeake & Ohio, Covington, Ky.

The repairs to freight cars may be divided into two general classes or grades: light and running repairs, which is that class of repairs accruing from current wear and breakages; and classified heavy, general and rebuilt repairs, which is that class of repairs involving the restora-

tion of the car as a whole to first class condition for a period of time.

Scheduling and routing

Many forms of scheduling and routing systems have been developed and successfully installed in locomotive and passenger car repair shops, but only in the last few years has any degree of perfection been reached in the scheduling of freight cars. Fundamentally, such systems are very similar in principle and application to freight cars, and there is no reason for assuming that a system, which has greatly benefited locomotive and passenger car repair shops, will not produce equally satisfactory results in freight car repair shops. The quantity of freight cars repaired automatically induces systematic operating methods; but the scheduling and routing of freight cars is more difficult on account of the large number and many types of cars, and the extensive area over which they operate as compared with either locomotives or passenger cars, which operate over one or two divisions while freight cars operate over the entire road and country. The most successful freight car scheduling is obviously dependent upon large operation and number of cars in the same series, sufficient material and supplies, and a complete organization which will enable men to be highly classified into special gangs. It is not really difficult to handle up-to-date scheduling and routing methods in freight car repair shops, but it may be necessary completely to rearrange or relocate repair tracks, material storage, and associated shop facilities.

Advantages and possibilities of progressive system

It has been conclusively demonstrated that with the progressive system of shop operation there are greater possibilities for economy and efficiency than with any other method yet devised. This system permits of properly organizing the shop forces, systematic delivery of materials at designated points and at defined intervals. It is conducive to specialization of the work by groups and individuals, which is an important factor in production. It lessens the multiplicity of tools and fixed equipment, also simplifies supervision as the men become familiar and more efficient in the execution of the particular operation for which they are responsible, and are induced to devise plans and means, and to provide themselves with suitable tools especially adapted to their portion of the work, which greatly contributes to increasing and improving output and reducing labor costs. The men become better satisfied and more interested in their work, cooperating closer with the supervisor; friendly rivalry or competition arises among the various gangs, striving not only to increase quantity but to improve the quality of work as well. All of these advantages and conditions greatly reduce the probability of personal injury to the workmen.

The only objection raised to the adoption of this system is the effort necessary to collect cars in the same series at the same shop in sufficient number to make the operation a success, and the possibility that work on another series of cars might retard the progress. However, it is possible, except perhaps on smaller roads, to overcome this difficulty by arranging a schedule of classified repairs to freight cars to extend over a period of from two to ten years, and cars in certain series can be shipped to the shop to which that series is allotted from other shop points. The advisability and practicability of shopping cars by series or classes is recognized, and most of the obstacles in this respect have been overcome to the extent that the method has become quite general in its application to heavy and classified freight car repairs.

On roads large enough to so arrange, cars in the same series may be allotted to two or more shops to eliminate all possible empty car haul.

Materials

One of the most important requirements of this system is the prompt delivery of materials, which should be done by tractors or electric driven trucks with trailers, unless the shop is equipped with overhead cranes. No work should be started on the repair schedule until material necessary to complete the program is on hand in sufficient quantities to carry on the work until the remainder required is received, that there may be no hold-up or retarding of the progress on account of shortage of material.

Suggestions for repairs

In the actual work of repairs it is suggested that draft gears, attachments, and center sill construction be sufficiently strengthened, so that the shocks incident to modern service will be absorbed and distributed throughout the car without causing excessive damage to the superstructure. Center sills and draft sills should have sufficient sectional area and should be protected against buckling by the use of cover plates. A common cause of failure in steel cars is due to the bodies of hopper cars not being securely fastened to the center sills. A few rivets are driven in the hopper sheets to hold the body to the center sills, and the heads corrode or wear off, allowing the rivets to pull through the sheets. This results in the whole strain being thrown on the body bolsters, which are usually of a wide single plate type, with result that they are unable to stand up under the strain. The sills start moving back and forth under the car which soon gets in such condition that permanent or thorough repairs become a rather expensive operation. These conditions must be overcome as far as possible when car receives heavy repairs, if it is expected to continue the car in service. The sides and ends of steel equipment should be properly reinforced to prevent bulging or buckling. Doors and door equipment and appliances should be kept in proper working order to facilitate unloading. Care should be taken in repairing trucks of all cars to provide proper side bearing clearance, and to see that air brakes and running gears are kept in good condition.

A well defined program of reinforcement should be outlined and put into practice on all roads. The cost of such additions and betterments is usually insignificant when the future life and productive service of the car is considered. Money appropriated for such features is a good, sound investment, when judiciously used, and should pay large dividends. Many roads make the mistake of repairing their older equipment in kind as they do not have exacting conditions on their line. Such equipment should either be reinforced or kept on their own line and not offered in interchange, when there is a possibility of it getting out into the large industrial centers and into heavy tonnage trains, when it is almost an impossibility to keep it off the repair tracks. This places an unnecessary burden of expense on both the owner and the handling line.

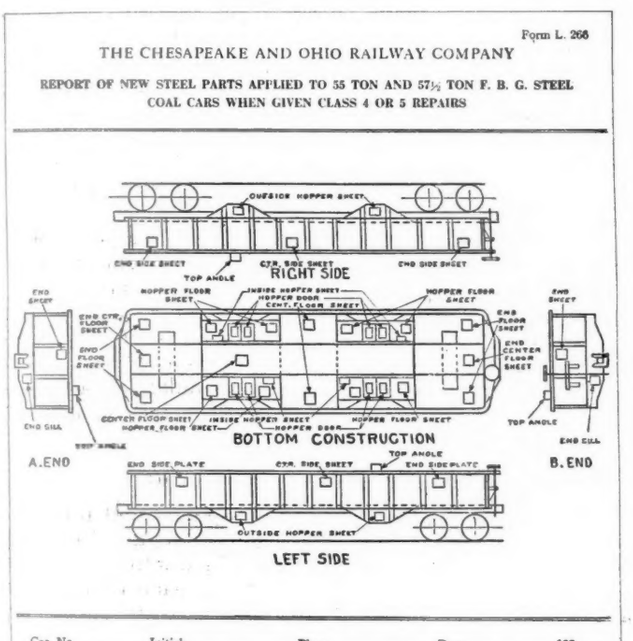
As cars come into the shop for general repairs, a careful inspection should be made; and, if a car has not deteriorated to the extent that it is felt advisable to scrap it, it should be repaired in accordance with a well defined reinforcement program, as outlined. Otherwise, if this is not done, after considerable money has been spent on the car it will again come back to the shop track.

Manner of handling work

A meeting of general, district and divisional car department officers is called three or four months before the close of the year, and the shopping schedule thoroughly dis-

cussed. A chart, previously prepared, showing the cars due for classified repairs or to be rebuilt the following year, is carefully considered and the cars are allotted to each shop represented, commensurate with its force and facilities. All cars in the same series are rarely allotted to one shop, but to at least two shops on opposite ends of the road. The cars to be rebuilt are selected by their general condition, the age being an important factor in determining just what parts of the cars are due for renewal. Past experience, tests, and service conditions and requirements under which steel car equipment operates, have demonstrated that floor and hopper sheets should be renewed every 10 or 12 years, while the side and end sheets will run for approximately 16 years before requiring renewal, if ¼-in. thick. A definite program of reinforcement is outlined and closely followed.

At least 90 days is allowed in advance of starting on the



Form L. 266

THE CHESAPEAKE AND OHIO RAILWAY COMPANY

REPORT OF NEW STEEL PARTS APPLIED TO 55 TON AND 57½ TON F. B. G. STEEL COAL CARS WHEN GIVEN CLASS 4 OR 5 REPAIRS

RIGHT SIDE

BOTTOM CONSTRUCTION

A. END

B. END

LEFT SIDE

Car No._____ Initials_____ Place_____ Date_____ 192__

Signed_____
Car Foreman.

INSTRUCTIONS

This report must be made for each 55 ton and 57½ ton F. B. G. Steel Car when given Class 4 or 5 Repairs by inserting the letter "X" in the square on each piece that is applied new, and mailed to the Supt. Car Dept. when the repairs are completed.

No parts are to be marked on this report that are removed for straightening or any other cause and replaced.

Form on which a record is kept of the new steel parts applied to each car

repair program to enable the purchasing and stores departments to purchase and deliver materials required; so, immediately following the allotment of cars to be rebuilt, each shop participating in the repair schedule places a requisition for 50 per cent of the material it will require, which should place this material on the ground in time to start with the year's program promptly. The other 50 per cent of the material is requisitioned in sufficient time so that it will be delivered in time to prevent any cessation of the work. If more than one series of cars are allotted to one shop, which is sometimes necessary, it is determined at the general meeting the order in which each series is to be routed through the shop and the material is ordered accordingly, the same advance information and consideration being given the stores department as mentioned above.

The entire schedule is laid down on a schedule and performance sheet, which permits the recording of starting and completion dates in proper sequence. The closest cooperation between the car and stores departments is absolutely necessary, not only to prevent any shortage of materials but also to avoid any surplus material being left on hand when the program is finished.

Classified repairs of steel cars

Cars in the same series are placed on bonded tracks equipped with electric rivet burning apparatus consisting of the following:

A generator supplying direct current not to exceed 80 volts, with 450 to 500 amperes for each cutting unit employed, located as near to cutting tracks as possible to prevent voltage drop.

Lead wires from generator to cutting stations of sufficient area to prevent excessive loss of watts.

A permanent scaffold six feet high and two feet wide, extending the entire length, and on both sides, of the burning tracks, the frame work of which is used for carrying the supply wires and having plug-in switches every 40 feet.

A rivet burning tool consisting of a graphite stick, held by a handle, of sufficient area to prevent excessive temperature resulting from heavy amperes carried.

A specially constructed mask to protect the operator's eyes and face from violet ray.

Cars placed on bonded tracks are inspected by a competent inspector or gang foreman. All sheets to be removed and replaced with new are marked with yellow crayon. All sheets and other parts to be removed, repaired and replaced are market with red crayon. All rivets not in sheets and other parts marked for removal, but necessary to be burned from draft lugs, center braces, door fastenings, etc., are also marked by the inspector.

Marked rivets, and rivets in sheets and other parts to be removed, are burned by placing the electric torch on the head or button of the rivet, depressing the head without injury to the sheets, stakes, or other parts that are to remain in the car. One operator burns out an average of 1,500 rivets each eight hours, and same operator cuts scrap sheets in shape for loading out as scrap; classification "Steel cars cut for shears." This operator is followed by an operator with a nine-inch pneumatic hammer, who backs out an average of 1,800 rivets each eight hours.

The major portion of the work done by electric burning and back-out rivet gangs is done on the second and third shifts, one burner and one back-out man forming a unit; but this operation can be extended over the three shifts or all be done on the first shift, depending on the track space and output desired.

When rivets are backed out the sheets are dropped, and the following day all scrap is picked up by a locomotive crane, equipped with a magnet, and loaded directly into cars to apply on a scrap sales order previously secured by the purchasing department. This eliminates unnecessary handling and the necessity of providing storage space to accumulate this class of scrap while awaiting sale. Parts to be repaired and replaced are pooled at the straightening shop, which is equipped with a furnace, a face plate, presses and necessary tools to restore parts to original shape. Nothing then remains but the skeleton car which is moved to the heavy repair tracks and the work proceeds from there as follows:

The second operation is performed by gang No. 2, or the truck gang. The cars are jacked up and placed on tripods, the trucks dismantled, and all broken or defective parts removed. This gang repairs all trucks and lets cars down on the trucks at the proper stage in the progress of the schedule. All arch bars are removed and taken to the smith shop where they are annealed and reset, by which process any crack or fracture is easily detected.

The dismantling gang, or gang No. 3, follows and backs out all rivits that cannot be taken out on the burner track, drops all couplers, draft gears, cylinders, reservoirs, bolster tie plates, space blocks, center plates, draft castings, and any other parts to be removed from the car.

Following the dismantling gang, the straightening gang, No. 4, straightens all parts that are to remain in the car, and prepares the car for the fitters.

The first fitters, or gang No. 5, follow and fit up all underframe work, end sills, tie plates, splice plates, space blocks, corner posts, sub-side sills, center plates, etc. Gang No. 6, the first reaming gang, reams the underframe, end sills, and all work fitted up by the first fitters, and makes the car ready for the first riveters.

The first riveters, gang No. 7, follow and drive all rivets under the car body and all rivets that must be driven before the car is fitted with side or floor sheets.

When entire sides are renewed, the side sheets, stakes, top and bottom angles are riveted up on the bench in jigs by gang No. 8, or the bench gang, and hung complete with locomotive crane by the 9th or second fitting gang. Gang No. 9, or the second fitters, working with an electric crane truck or locomotive crane, fit up the body of the car, hanging with special fitting up bolts, sides complete, side and end sheets or floor, hopper and cross ridge sheets, side and end posts; top and bottom, side and end rails, tie braces, side knee braces, etc. Gang No. 10, or the second reamers, follow and ream the entire body and prepare for the body riveting gang.

Gang No. 11, the second or body riveters, then drive all rivets in the body of the car, grab irons, sill steps, brake shaft platform and brackets, door attachments, etc. One gang fits up all door locks ready for final or OK riveters.

Gang No. 12, or the coupler gang, works in at any time after the bottom of the car has been driven. This gang puts up all couplers, uncoupling levers, card boards, brake mast, brake rods, brake levers, center pins, lock doors, greases center plates and side bearings, lets the car down on trucks, gages couplers and adjusts side bearing clearance.

Gang No. 13, OK riveters, works in one gang, driving all rivets in door locks, front carrier irons, and any rivets overlooked by regular riveters or missed by reaming gang, and drives all rivets marked out by the inspector. This method insures that all the work is properly performed.

Acetylene burners work in one or two gangs of one car repairer and one helper each, cutting out any rivets necessary to leave in on the burning track, cutting out bolster web plates for center sill splice plates, and any other work necessary to keep the regular gangs moving.

Laborers and helpers form a material delivery gang and work as follows: One man operates each electric truck engaged in the distribution and delivery of material, and, with two or more men, delivers to the car and truck all sheets, posts, rails, truck frames, wheels, spring planks, bolsters, and any other heavy materials. They also handle all couplers, arch bars, truck side frames, and other material, to and from the smith shop. One man keeps the rivet heating furnaces in repair and looks after the oil supply for rivet furnaces and heating torches. One or two men deliver to the cars and trucks all light materials such as grab irons, card board, brake mast and platform, ratchet wheels, brake hangers, brake levers, brake hanger rods, bottom connections, journal boxes, lids, brass and wedges, and bolts, nuts and rivets in quantities.

Located convenient to shop tracks are sufficient material racks with bins in which are kept short bolts, nuts, washers, cotters, clevises, knuckle pins and locks, brake pins, nut locks and grip nuts, and other small materials which are used in small quantities. One man takes care of these racks, replenishing the stock daily, and he also picks up any usable material left on the ground by carmen, returning it to the proper bin in the nearest rack. A standard list of material to be carried in each rack is posted, and each forenoon the attendant makes a check of the material on hand in these racks, and any shortage is ordered at one time and replaced in proper bins. This keeps a stock of such material on hand and convenient for the carmen's use at all times, thus eliminating the probability of waiting for the delivery gang or of hunting up the foreman for an order to the store room.

When cars are ready to paint they are moved to the shipping track where the air brake men, two car repairers and one apprentice repair and put in first class condition train lines, brake cylinders, and reservoirs; applying triple, release and retainer valves, angle and cut out cocks, hose and dirt collectors, which are cleaned and repaired in accordance with A.R.A. Rules governing the Maintenance of Brake, Train and Air Signal Equipment; connect, test and adjust brakes. Train lines, hose and all connections are given soap suds test; brake cylinders are given leakage test by gage; and triple valves are cleaned, repaired and tested on a standard test rack.

The cars are painted on the shipping track with a paint spray, working from a push car running on the service track along side of the car. On this push car are carried all supplies and materials required to coat the setting. When the paint is dry the stencilling is done from a scaffold erected on a push car, on which all supplies and stencils, made in panels, are carried. The painter moves himself on this push car by taking hold of the side of the car and pulling the scaffold and push car with him to the desired location.

Final inspection is made of cars on the shipping track, and any work marked out by inspector is corrected, if possible, before the painter has left the car. Cars are then reported ready to be pulled and weighed.

An individual car record of sheets removed is kept on special forms, as shown in the illustration. These forms are filed numerically and the record is available at all times in the general office to determine the general condition of an individual car of the series.

Classified repairs to box cars

After cars in the same series are spotted and properly spaced, they are carefully inspected by the gang foreman, accompanied by the stock clerk, and all parts to be renewed or repaired are so marked, and check made of material available, and necessary action taken to have all material on the ground when required.

Gang No. 1, or the truck gang, jacks up all cars in the setting, runs out the trucks and lets the cars down on trestles or tripods in a safe manner, after which it dismantles the truck, removing all defective or broken parts. All arch bars are removed and taken to the smith shop where they are annealed and reset. This gang is so regulated that trucks are rebuilt when the car is ready to let down.

Following the truck gang, the stripping gang, or gang No. 2, consisting of two car repairers and sufficient laborers to keep the yard clean of scrap lumber, removes all trimmings, drop couplers and draft gears, defective or broken siding, flooring, lining and roofing.

The sill and frame gang, gang No. 3, follows and removes all defective or broken sills, posts, braces, side plates and end plates, belt rails, purlines, ridge poles and carlines, replacing them with new, squaring the car, tightening all sill and plate rods, trussing car, repairing and replacing couplers and draft gear, and letting car down on truck. This gang also removes, repairs and replaces body bolsters and draft arms.

The fourth operation is performed by the sliding gang, which applies all siding, side and end fascia, door tracks and top corner bands. The roofing gang, gang No. 5, follows and patches or applies roofs complete with running boards. The flooring gang, gang No. 6, patches or applies new floor complete. This gang is followed by gang No. 7.

the inside or lining gang, applying or patching all end and side lining and grain strips.

Gang No. 8, or the safety appliance gang, follows and applies all grab irons, sill steps, lift levers, center corner bands, brake shafts, front and back door stops, and hangs the doors. The doors are repaired or made new and trimmed in the door shop and delivered to the car ready to hang.

The steel gang, gang No. 9, consisting of two or more car repairers and apprentices, is what may be termed a floating gang, doing any steel work required, such as straightening riveting, etc., and works closely in touch with the sill and frame gang. The acetylene gang, consisting of one car repairer and one apprentice, works wherever needed and has no regular routing to follow.

The air brake men are the last to finish their work of repairing and putting up train lines, brake cylinders, reservoirs and triple valves, and connecting, testing and adjusting brakes. Triple valves are repaired, cleaned and tested on a standard test rack.

Where the shipping track is provided the cars are pulled from the shop track and spotted on the shipping track, where painters and air brake men perform their portion of the work, similar to the same operation on cars of steel construction.

The painters follow closely behind all wood working gangs, painting sills, belt rails and plates ahead of siding, roofing and flooring gang, whom they follow closely. Cars are all painted and stencilled when the air brakes are tested. After a final inspection the cars are ready to pull. The yardmaster is so notified; and a list is furnished him of the cars to be set in after OK'd cars are pulled from the tracks.

The working of cars in the same series is an advantage to all departments. The siding, roofing, flooring and lining is cut to length in the mill. The same material, bolts, castings and timber are used throughout the entire setting. The painter need carry only one set of stencils for the series of cars being repaired.

The number of men in the various gangs, on both steel and wood cars, is governed by the amount of room on shop tracks, facilities, the output desired, the class of equipment undergoing repairs, and the amount and character of repairs, reinforcements, etc., necessary and applicable to the majority of the cars in the setting.

Requirements

What is needed more than anything else is a systematic program for making heavy repairs to freight cars so that a certain percentage of the equipment will be given such repairs each year, this percentage to be based on the number of years a car can safely run between heavy repairs. Locomotives are shopped on a mileage basis. Why not establish a reasonable and scientific basis upon which to shop freight cars and then see that it is lived up to. This will keep the equipment in prime condition, at a minimum of expense, after a systematic program has been well established.

Shops should be provided at points where heavy repair car work is performed. Overhead crane service is desirable and by proper arrangement eliminates the necessity for material or service trucks between the working tracks. Small wall of jib cranes should be installed for handling yoke riveters, etc. The money expended for shops will repay the investment many times over in a few years.

There is a large field for consideration and planning, when designing new shops, to provide proper tracks and facilities, which will co-ordinate with production systems and schedules best adapted to produce maximum output and minimum cost.

Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Another case under Rule 32

C., M. & St. P. car No. 9403 received some damage while in possession of the N. Y. C. & St. Louis which it was claimed occurred in the ordinary switching service and disposition was requested from the owners in accordance with Rule 120. The car owner claimed that the damage was due to the handling line responsibility. In making its contentions, the car owner stated that it had received a letter from the handling line which stated, among other things, that it was not the practice to ride cars in Conneaut Yards where the accident occurred. The car owner further contended that the damage exceeded that specified in the footnote to Rule 43. The handling line contended in its statement that it had received the car in question from the N. Y. C. at Buffalo, N. Y., at which time an inspection was made which revealed a number of defects. In view of these defects the car was billed home to the owner at Chicago. It was while the car was en route home that it was damaged in switching service which caused eight sills to break on the car. As the car was not derailed, roughly handled or damaged in any other manner outlined in Rule 32, the handling line felt justified in requesting a settlement in accordance with Rule 120.

The Arbitration Committee rendered the following decision "The car being handled without rider protection, the handling line is responsible as per Rule 32, Section D, Item 4. See Arbitration Decisions Nos. 1224 and 1331.

"In the event repairs are made, the car owner is responsible for that portion of the defects which are ordinarily the owner's responsibility and not associated with the delivering line defects, as provided in Rule 41."—*Case No.* 1335, *Chicago, Milwaukee & St. Paul vs. New York, Chicago & St. Louis.*

Wheels remounted on Standard A. R. A. axles with wheel seats in excess of standard diameter

The Chicago, Burlington & Quincy included in its bill to the Southern Pacific a charge amounting to $36.06 for repairs to S. P. car No. 62342 at Alliance, Nebr., November 30, 1921. The bill in question bore no date, but represented the account as of November, 1922, and contained charges for repairs made on November 30, 1922. The car owner contended that revisions of Paragraph 2, Section A, Interchange Rule No. 91 of the 1921 Code, had been violated. The C., B. & Q. also included in this bill a charge for wheels and an axle changed under S. P. car No. 24846 at Alliance, November 17, 1922, on account of one wheel being tread worn and the other having a large bore, at the same time scrapping the axle on account of large wheel seats. The car owner contended that the axle should have been credited at second-hand value. In defense of the first part of the agreed

statement of facts, the S. P. contended that the second paragraph of Section A, Rule 91, distinctly provides a time limit of one year within which charges for repairs are to be represented. With respect to car No. 24846, the S. P. contended that the wheel and axle record represented by the repairing line shows the diameter of the wheel seats for the axle removed to be 7⅛ in. This was ⅛ in. larger than the dimensions for the new axle as specified in the table in Rule 86. However, its interpretation of this table was that the diameters for the wheel seats and center are minimum, and that there should be no objection to slight variations which in themselves actually increase the strength of the axle. The C., B. & Q. contended in its statement that it had complied with both the letter and spirit of Rule 91 and that the bill was actually made and rendered in November, 1922, with the necessary delay required to add final entries and make recapitulations along with 500 other bills for the same month. With reference to the renewal of the wheel and axle under car No. 24846, the handling line claimed that an axle for the minimum limit of wheel seat prescribed by the table in Rule 86 is in effect scrap and that wheels fitted to such an axle are likewise scrap regardless of whether the wheel seat dimension is great or small.

The Arbitration Committee rendered the following decision "With reference to the time limit for rendering a bill, Arbitration Decision No. 1228 is parallel. The contention of the C., B. & Q. is sustained.

"The general situation is such as to warrant the practice of using A.R.A. standard axles with wheel seats not more than ⅛ in. in excess of standard diameter for remounting second-hand wheels, in order to avoid scrapping good wheels. The 1924 Code of Rules will be modified to make this clear. Therefore, the contention of the C., B. & Q. is not sustained."—*Case No.* 1333, *Southern Pacific vs. Chicago, Burlington & Quincy.*

Credit for wheels removed because loose on the axle

On March 11, 1922, the Atlanta, Birmingham & Atlantic exchanged wheels under Illinois Central car No. 131255 showing under the "Why Made" column one wheel OK, one wheel loose on the axle and scrap on which a charge was made against the car owner for one pair of second-hand wheels applied, less one second-hand and one scrap wheel removed, or $3.60, it being claimed by the repairing line that the wheel scrapped was unfit for further use owing to having been removed from a standard axle. The I. C. maintained that both wheels removed should have been considered under the existing condemning limits as second-hand inasmuch as the A.R.A. rules make no provision for the scrapping of wheels for such causes as claimed by the repairing line.

In rendering its decision, the Arbitration Committee stated that "If the loose wheel was unfit for remounting on a standard axle with a wheel seat not more than ⅛ in. in excess of the standard diameter, it should be credited as scrap. If it could be so remounted, it should be credited as second-hand.—*Case No.* 1334, *Illinois Central vs. Atlanta, Birmingham & Atlantic.*

Car without rider protection damaged in switching service

On June 20, 1923, Canadian National car No. 610862 was damaged while being switched at South Chicago and was reported by the Chicago, Rock Island & Pacific showing an estimated cost for labor of $185 and material of $200, making the total $385. The damage occurred when two cars of coal, without rider protection, ran into C. N. car No. 610862, breaking it in two at the middle. The handling line contended that the responsibility for the damage to the car did not come under Rule 32, Section D, Item 4, nor the footnote to Rule No. 43 for two reasons: first, that only five sills were broken new which was evidenced by the records which show that when the car returned through interchange to the handling line, one side sill and two intermediate sills were broken, were old or decayed and were broken prior to the time the car was broken in two in switching service. Second, the car was not derailed, cornered or sideswiped. The handling line further claimed that rider protection was not necessary as the accident occurred in a level yard while the cars were being switched at ordinary safe speed. It was the contention of the car owner that the handling line was responsible under Rule 32, Section D, Item 4, and that the car should be handled under Rule 112, as no rider protection was provided.

The Arbitration Committee in rendering its decision stated that "The damage exceeded that shown in the footnote to Rule 43 and as car was being handled without rider protection, the handling line is responsible as per Rule 32, Section D, Item 4."—*Case No.* 1336, *Chicago, Rock Island & Pacific vs. Canadian National.*

A convenient type of portable scaffolding

AN interesting feature of the car building contest recently held by the car department of the Delaware & Hudson at Carbondale, Pa., was the numerous kinks and unique practices used by the three contesting teams. The Oneonta team, the victors in the contest, were

Scaffolding arrangement used by the Oneonta team, victors in the D. & H. car repair contest

especially well equipped with various improved tools and devices for efficiently performing the work. One of these devices is the portable scaffolding shown in the illustration.

The planks for the floor of the scaffolding are placed on a bracket made of round bar iron about 1¼ in. in diameter. The bar is bent so as to hook over the side of the car and extend down to form a support for the plank, as shown in the illustration. It is held in position against the side of the car by means of a brace made of ⅜ in. by 1¼ in. wrought steel bar. The brace is made in two pieces, bent to the same shape, so as to form a clamp for the round bar at one end and a base at the other. The two pieces are then placed back to back, clamping the round bar as shown in the illustration, and held securely by three ½-in. bolts.

Master Painters meet at St. Paul

Methods of securing satisfactory painting results with the least expenditure of time and money are discussed

THE fourth annual meeting of the Equipment Painting Section of the Mechanical Division, American Railway Association, was held at St. Paul, Minn., the week of September 14, 135 master painters representing railroads in all parts of the country being in attendance. Much of the discussion centered on methods of painting railway equipment which would produce satisfactory results at the least cost and at the same time hold equipment out of service as short a time as possible while in the paint shop. Considerable emphasis was placed on methods of testing paints and several engineers of tests from various railroads discussed the problem of painting from this angle. Steps were taken to place railroad testing of paints on a more scientific basis.

The master painters were welcomed to St. Paul on behalf of the railroads by E. F. Flynn, assistant to the vice-president of the Great Northern, who made an inspiring address on the improved relations between American employers and employees which has taken place in recent years. He pointed out the dependence of each on the other and said that only by mutual helpfulness can American ideals and the present high standard of living be maintained.

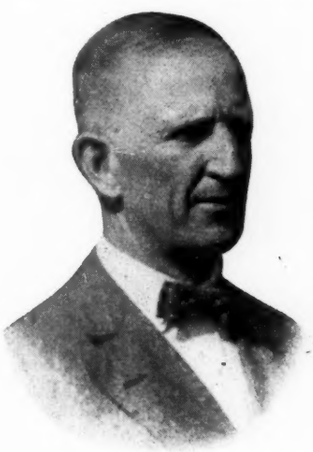
During the meeting tribute was paid to Secretary V. R. Hawthorne when the members presented him with a solid gold railroad watch in token of appreciation for his faithful services in the interests of the Equipment Painting Section and its predecessor, the Master Car and Locomotive Painters' Association.

Election of officers

The following officers were elected for the year 1926: Chairman, A. E. Green, foreman painter, Chicago & North Western, Chicago; first vice-chairman, James Gratton, general foreman painter, Buffalo, Rochester & Pittsburgh, Dubois, Pa.; second vice-chairman, F. E. Long, foreman painter, Chicago, Burlington & Quincy, Aurora, Ill. According to the regulations of the Section, the last two past chairmen automatically become members of the Committee of Direction, which together with the three above make the Committee of Direction of the Equipment Painting Section as follows: H. Hongeveld, master painter, Atlantic Coast Line, Waycross, Ga.; B. E. Miller, master painter, Delaware, Lackawanna & Western, Kingsland, N. J.; H. C. Allehoff, foreman painter, Oregon-Washington Railroad & Navigation Company, Portland, Ore.; L. B. Jensen, general foreman, passenger department, Chicago, Milwaukee & St. Paul, Milwaukee, Wis.; D. C. Sherwood, foreman painter, New York Central, West Albany, N. Y.; J. McCarthy, foreman painter, Canadian National, Montreal, Que.; W. Mollendorf, foreman painter, Illinois Central, Chicago; G. H. Lehnen, foreman painter, Chicago & Eastern Illinois, Danville, Ill.; A. H. F. Phillips, foreman painter, New York, Ontario & Western, Middletown, N. Y.; Marceau Thierry, foreman paint shop, Norfolk & Western, Roanoke, Va.; J. N. Voerge, general master painter, Canadian Pacific, Montreal, Que.; and J. McDowell, foreman painter, Chicago, Rock Island & Pacific, Chicago.

Abstracts of several of the papers are given below. The papers dealing with testing will appear in a later issue.

F. W. Bowers (Erie)
Chairman



A. E. Green (C. & N. W.)
First vice-chairman

James Gratton (B. R. & P.)
Second vice-chairman

Apprentice systems

By J. W. Gibbons

General master painter, Atchison, Topeka & Santa Fe, Topeka, Kan.

The writer has always advocated that for the first three years students for all crafts could and should have the same studies. The fourth year should be specialized along the lines of the craft he is learning. The painter apprentice should be taught free hand drawing, designing and elementary lessons in the chemistry of oils and pigments and their relative protective qualities. He should be encouraged to read well chosen text books containing

the fundamental principles of the painting craft. And as this may be considered the iron and steel age, he should be taught the elements that enter into their destruction and the best means of preserving them.

In addition to the school, the Santa Fe has shop instructors whose duty it is to teach the boys the practical side of the application of paint and designing of letters and ornamentation, as well as to emphasize the fact that the first and most essential reason for painting is preservation of the surface and that ornamentation is only a secondary consideration. It is up to the foremen and apprentice instructors to realize their responsibility in handling the apprentice assigned to them. We take the place of the teacher in educating the youth of today so he will be the craftsman of tomorrow. We teach him to breathe a soul into his work, in fact, the future of the boy is in our hands. The habits he forms as an apprentice will remain with him when he becomes a mechanic. If he learns to do work neatly and correctly as an apprentice it will be no trouble to do it when he graduates. If he gets the correct view of the relation a workman has to his foremen and instructors, he will retain it. If we treat him gruffly and instruct him grudgingly, he will assume that attitude toward us and our work. Worse than that, he will take it for granted that we are representatives of the company that employs us and he will become a pessimist as to the good faith in the promises of fair treatment made to all employees by higher officers. We can make the boy a good, loyal mechanic, or we can make of him an indifferent, careless workman, whose mind is in rebellion against all authority. A boy, unconsciously, is affected by examples of those around him, especially those who have authority over him.

Supervisors should always remember that it is their duty, not only to teach the boy a trade, but to build character, to assist the boy in acquiring a personality. Give him faith in humanity; make him a thorough craftsman.

Shop construction committee discusses mechanical painting

It is a well known fact that a shop of modern construction and equipment is a great help towards economy and efficiency. If a shop and its equipment are ancient, then economy and efficiency are crippled to some extent.

We understand that our railroads have not gone very deeply into the mechanical painting of passenger car bodies. We who have used the mechanical system of painting know of the many objectionable features when used inside of the shop buildings. The fumes and mist that arise from the operation endanger the health of the operators and those who are required to be in the immediate locality and the mist settles on other equipment. If mechanical painting is used to any extent, the work should be confined to a certain section of the shop provided with booths or screens to protect other equipment. This section should be ventilated with a vacuum system, so that the fumes and mist can be removed through the ventilators.

The mechanical painting of removable and small parts is being done by the use of different kinds of devices, and a great deal of thought, time and money have been expended by various concerns in the manufacture and improvement of mechanical painting devices. A number of railroads have made or are making trial applications with mechanical painting devices for locomotives and coaches with lacquers and different kinds of finishes. Pyroxylin finishes are now produced by a large number of manufacturers under many different trade names. About all of these materials are made on the general principle of a nitro-cellulose base dissolved in various liquids of a highly volatile and inflammable nature. The fire hazards involved are very great and great care should be taken in equipping the place or building with fire protection, where mechanical painting is done.

(The committee's recommendations relative to the design of the paint, cabinet and pattern shops, and also removing paint by the sand blast process, are the same as those made by the Committee on the Design of Shops and Engine Terminals at the 1925 annual meeting of the Mechanical Division, A.R.A. An abstract of this report was published in the July, 1925, *Railway Mechanical Engineer*, page 412.—Editor.)

The report was signed by the chairman A. H. F. Phillips, N. Y., O. & W.; O. S. Minnick, W. M.; C. E. Ream, Penn.; J. T. MacLean, B. & M., and W. F. James, A. C. L.

Maintenance and care of paint and varnish at terminals

Freight and passenger locomotives should be cleaned before every trip. Where a washing machine is available, the locomotive should be placed on a wash track and the drivers, trucks, frames, spring rigging and tender trucks washed. These parts should then be wiped with kerosene. Jackets, cabs and tenders should be wiped with waste saturated with renovator, followed by dry wiping with waste. The front end should receive a suitable front end paint, and where the paint shows a tendency to scale, it should be removed and cleaned to the bare iron and repainted before the engine is placed in service.

Passenger locomotives should be repainted every nine months. Freight locomotives every twelve months and switching locomotives every fifteen months. The painting of locomotives should be done in stalls partitioned off for this purpose which should always be properly heated, ventilated and lighted.

Exterior cleaning of passenger cars

The exterior of passenger cars are to be washed daily with cold water before the cars leave the terminals. The exterior of cars used in first class trains and main line service should be washed with a solution of oxalic acid every 30 days or when the condition of the cars demand it. After applying the acid and all grease and dirt has been loosened, the acid and dirt should be washed off with cold water. Care should be taken that no acid and dirt remains on the body of the car.

The solution of oxalic acid should be 20 lb. dissolved in 50 gal. of hot water. It must be thoroughly dissolved and allowed to cool and applied cold.

The bodies of passenger cars should be renovated after each periodical washing, as this will destroy the effectiveness of the acid and stop it from working into the open joints, window sash brads and open sheathing. To apply the renovator use a handful of waste moistened with renovator and after it has been applied, care should be taken to see that the surface is thoroughly wiped dry and clean with clean waste. First class cars should be washed with oxalic acid and renovated every 60 days. New and newly painted cars operating in first class trains and main line service, should not be washed until a period of 20 days has elapsed. Trucks should be sprayed or wiped with distillate oil and washed with soap and water. All washing compounds and soda solutions must be avoided, as these compounds will destroy the varnish and paint.

Interior cleaning of passenger cars

All passenger cars should be blown with compressed air and all dust removed, before washing the head lining, wall pipes, and seat arms. They should be washed with a

solution of soap and water, then rinsed and dried with a chamois skin. The solution of washing material should be put in one pint of diluted vegetable oil soap to a bucket of water. Floors should be mopped and care taken that not too much water remains on the floor, causing the floor to become water soaked, which is injurious to the under frames of passenger cars. Toilets, baggage and express car floors should be washed with a solution of one-half pint of disinfectant to 12 quarts of water. Vestibules should be washed with soap and water and dried with a chamois skin. The interior of the cars should be gone over with a suitable furniture polish or renovator when the varnish becomes dry and dull looking. This work should be done by experienced men.

Painting of passenger cars

Terminal painting—When the cars present a bad appearance they should be held out of service and have the parts repainted that demand it, at the coach yards. The painting of the roof, steps, trucks, vestibules, sash, head lining, seat arms, foot rests and guards, pipes, pedestal and floors, should be done under the supervision of experienced employees.

A great many railroads have applied lacquer to passenger cars for test purposes and your committee recommends that all such cars be washed with a solution of vegetable oil soap and rubbed thoroughly dry after each period of 30 days. The secret of success in the cleaning of this equipment is the thorough rubbing after it is cleaned, as this brings about a high gloss that is much desired.

The report was signed by G. Schwantes, chairman, C., M. & St. P.; J. J. McNamara, B. & O.; J. H. Whittington, C. & A.; J. McCarthy, C. N., and H. E. Brill, A., T. & S. F.

Report of committee on standards—Cars and locomotives

What success, if any, has been obtained to prevent paint peeling from galvanized iron car roofs?—It is the consensus of opinion of the committee that galvanized iron, when new, should only receive one coat of company standard paint for appearance sake. The result of tests shows that asbestos fibre cements have adhered better than the ordinary carbon blacks or oxide paints, and have proved more permanent.

The most practical and economical method of bringing up interiors of steel passenger coaches for graining or coloring.

First day—Sand blast and apply railroad company's standard steel car primer.
Second day—Stand to dry.
Third day—Apply coat of steel car surfacing.
Fourth day—Putty and knife where necessary.
Fifth day—Sandpaper and apply first coat of railroad standard enamel.
Sixth day—Stand to dry.
Seventh day—Apply finishing coat of enamel.
Eighth day—Apply standard ornaments, striping and necessary notices.

In cases where cars are to be grained, two coats of ground color should be applied, allowing 24 hours for drying between each coat; the first coat of ground color to be applied on the fifth day, instead of enamel. Then grain and apply the first coat of varnish. Apply the necessary ornaments and notices, followed by two coats of varnish.

Where rub finish is required, 48 hours should be allowed after the last coat of varnish. Rubbing should be done in accordance with railroad shop practice.

The most practical and economical method of bringing up the exterior of steel passenger coaches—Where finish and appearance would be acceptable to the railroad company officers, your committee would recommend the following system, as it would provide ample protection:

First day—Sand blast and prime with approved steel car primer.
Second day—Stand to dry.
Third day—Apply coat of steel car surfacing.
Fourth day—Putty and knife where necessary.
Fifth day—Sandpaper and apply coat of standard color semi-gloss and of sufficient covering qualities that one coat will cover.
Sixth day—Ornament and letter. If the shade of body color used requires two coats, the second coat of color can be applied in the morning and lettered on in the afternoon. Follow with two or three coats, in accordance with shop practice, of coach finishing varnish to be applied.

What is the most economical and practical material for passenger car headlinings?—This committee recommends from a maintenance standpoint agasote, panelyte or similar material, as the most economical and practical material for passenger car headlining.

Standard for painting of passenger and freight locomotive cabs, domes and tenders—This committee recommends the following system as a standard for painting of passenger and freight locomotive cabs, domes and tenders:

1—Sand blast should be used for removing all old paint and scale from the metal.
2—The primer and surfacers used should be all black in color. The reason for recommending black undercoatings is that one coat of black locomotive finish will cover more solidly, and abrasions will not show as readily as with lighter undercoatings.
3—After lettering, apply one coat of finishing varnish on freight and two coats on passenger locomotives. Both black locomotive varnish and finishing varnish should be resistant to either hot or cold water.

The report was signed by G. H. Lehnen, chairman, C. & E. I.; J. N. Voerge, C. P.; A. E. Green, C. & N. W.; D. C. Sherwood, N. Y. C.; K. J. Johnson, N., C. & St. L., and F. E. Long, C., B. & Q.

Painting of freight car equipment

A great majority of the new steel equipment is not being sand blasted before painting, causing the paint to peel in a short time. This committee considers it most important to sand blast equipment, whether new or old, before painting and then prime with an approved standard metal protector. A primer made of chromate of lead has been found to be very durable. For open top cars, this primer can be followed with two coats of carbon black.

On steel box cars, after sand blasting and priming, apply two coats of oxide of iron, thinned to a brushing or spraying consistency with two-thirds boiled linseed oil, and one-third thinning oil. All steel underframes should be sand blasted and coated with a good metal primer, followed with at least one coat of standard body color. We do not consider it necessary to paint trucks other than new.

Steel or galvanized iron roofs, after being sand blasted, should be primed with the same material as the body, followed by two coats of the railroad company's standard roof paint. All stencilling should be done with white lead in oil, thinned to stencilling consistency, with boiled linseed oil. On new box cars, the interior of all steel plates, posts, braces, etc., should be painted with a good metal protector and one coat of oxide of iron applied. A good heavy red lead, or satisfactory metal protective paint should be applied on all new cars where metal overlaps, or is joined.

We recommend the following for new wooden equipment: All steel underframes should receive the same treatment as for steel cars. The outside of the sheathing, and all sides of roof boards and saddles, should be primed

with oxide of iron and boiled linseed oil before being applied to the car, after which two coats of oxide of iron should be applied, thinned to a brushing or spraying consistency with two-third boiled linseed oil and one-third thinning oil.

Roofs, if wood, should receive the same treatment as the body of the car. If metal, the same treatment should be given as on steel equipment. All stencilling should be done with white lead in oil, thinned to a stencilling consistency with boiled linseed oil. In the maintenance of old equipment, all new work should receive three coats and old work two coats of oxide of iron. Underframes on old equipment should receive one coat of standard body color. Roofs should receive two coats of railroad standard roof paint.

Owing to the necessity of getting this equipment into service with dispatch, we recommend that all painting be done by the mechanical method. While climatic conditions on certain railroads may require a slight change in the outer coatings, the committee believes that the above would be a good general practice.

The report was signed by the chairman D. C. Sherwood, N. Y. C.; Edward McDade, G., C. & S. F.; E. S. Butcher, F. W. & D. C.; C. O. Smith, B. & L. E.; H. C. Allehoff, O. W. R.R. & N. Co.

Applying corrugated steel ends to box cars

THERE are many car repair yards having considerable work to do in repairing box cars, that are not provided with adequate crane facilities to handle the work and it is a difficult job to apply corrugated steel ends without the assistance of a crane. One car shop, however, has been able to perform this work quite effectively by means of the trestle and derrick shown in Figs. 1 and

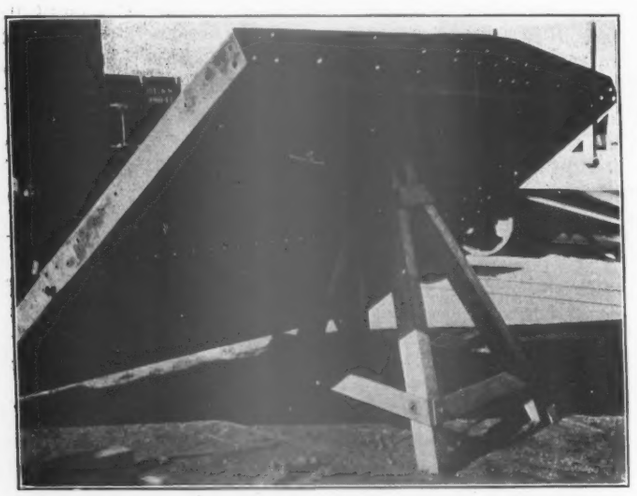


Fig. 1—The trestle holds the car end in such a position that the car repairman can work underneath

2, respectively. Referring to Fig. 1, the trestle is constructed with grooves in the top that fit the corrugations on the car end. The top is sloped so that the bottom of the car end rests on the ground and the top is elevated sufficiently so that a car repairman may work underneath.

Car ends are placed in position and applied by means of the derrick shown in Fig. 2. The derrick consists essentially of two timbers which form the legs and are braced by two cross-pieces. It is placed in position as shown in Fig. 2, and held by blocks and tackle, one block is secured to the top and the other to an adjacent car.

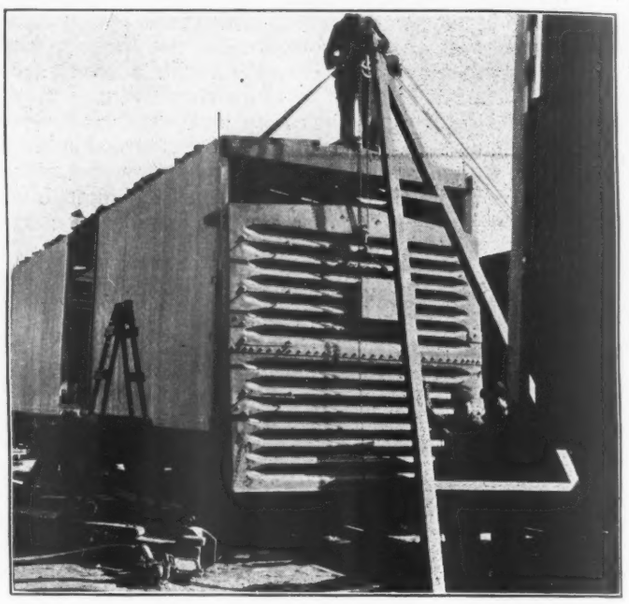


Fig. 2—Applying a corrugated steel end with a derrick and chain hoist

In this way the derrick may be adjusted to any height desired. The car end is then raised to position with a chain hoist.

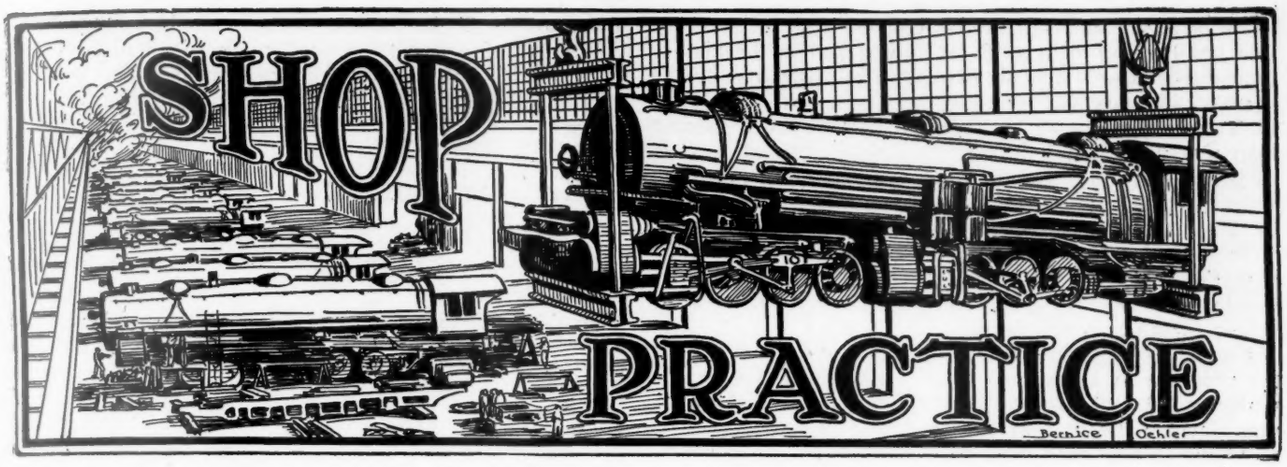
Perpetual examination of brasses*

DURING the past few months I have observed a practice which may be termed "perpetual" rather than "periodical" examination of brasses. The method appears the most logical of any I have studied and is bringing splendid results. A "hot box" out of the terminal coach yard is a rare occurrence.

Instead of examining the coaches in the yard when the journals are cool, an inspector of unquestioned ability is stationed at the terminal depot, where the journals can be examined immediately on arrival of the train when they are still at a running temperature. The inspector feels every journal, in addition to making a careful visual examination. When he finds a journal warmer than normal, he marks the box for examination, knowing there must be something which caused the excessive heat, not necessarily knowing what. This box is jacked up when the car reaches the coach yard, the trouble ascertained and the remedy applied.

There are a great many terminals, both passenger and freight, where this could be followed and a "perpetual" examination of brasses made which might make unnecessary the "periodical" examination. It would seem more dependable to determine conditions by actual running temperatures than by a "cold" examination, which will not disclose many defects, such as cracked linings, defective wedges, too old "dope," etc. A high running temperature does indicate one or more undesirable and possibly dangerous conditions.

*An extract from a paper by W. H. Davis, service engineer, Universal Packing & Service Company, Chicago, entitled "Practical lubrication of railway equipment," read December 1, 1924, before the Cleveland Steam Railway Club at Cleveland, Ohio.



Tool foremen meet at Chicago

Thirteenth annual convention best attended and most interesting recently held

THE thirteenth annual convention of the American Railway Tool Foremen's Association, held September 2 to 4 at the Hotel Sherman, Chicago, surpassed both in point of view of attendance and interest in the valuable reports and papers presented, any convention of this association held in recent years. The opening address was made by H. T. Bentley, general superintendent of motive power and machinery of the Chicago & North Western, who commented on the importance of the work of railway tool foremen and pointed out the opportunity which they have of saving money for the railroads by providing more efficient tools with which employees in shops and enginehouses can work. The tool foreman's responsibilities were discussed by G. T. Martin, assistant to the general superintendent of motive power of the Chicago, Milwaukee & St. Paul, and the proper machine equipment for toolrooms by C. A. Shaffer, general supervisor of shop machinery and tools of the Illinois Central. E. J. McKernan, general supervisor of tools of the Atchison, Topeka & Santa Fe, discussed "Economies possible by standardized small tools," and E. L. Woodward, western editor of the *Railway Mechanical Engineer*, read a paper entitled, "The importance of the toolroom to the railroads," emphasizing some ways in which the toolroom can be operated to help reduce shop and enginehouse costs. E. A. Hildebrandt, tool foreman of the Cleveland, Cincinnati, Chicago & St. Louis at Indianapolis, presented some pertinent remarks on "Co-operation." An abstract of the papers and reports presented at the convention will appear in this and subsequent issues of the *Railway Mechanical Engineer*.

Election of officers

The new officers of the association elected for 1926 are as follows: President, E. A. Hildebrandt, tool foreman, Cleveland, Cincinnati, Chicago & St. Louis, Indianapolis, Ind.; first vice-president, O. D. Kinsey, general supervisor of tools, Chicago, Milwaukee & St. Paul, Milwaukee, Wis.; second vice-president, E. L. Graeme, tool foreman, Delaware, Lackawanna & Western, Scranton, Pa.; third vice-president, W. R. McMilligan, tool foreman, Missouri-Kansas-Texas, Parsons, Kan. G. G. Macina, Chicago, Milwaukee & St. Paul, Chicago, was elected permanent secretary-treasurer of the association. The newly elected executive committee consists of E. C. Heingarten, (C. & N. W.), M. J. Harney, (N. Y., N. H. & H.), J. T. Sumner, (M. C.), L. C. Brown, (C. B. & Q.), and W. J. Hynes, (M. P.).

The tool foreman's responsibilities

By G. T. Martin

Assistant to general superintendent of motive power, Chicago, Milwaukee & St. Paul, Chicago

To obtain a practical demonstration of the tool foreman's responsibility, it is only necessary to be close to a job where a mechanic is trying to do a day's work, with a motor that will not function properly, or a reamer that fails to cut or perhaps an air gun that fails to do business. In cases of this kind, the tool foreman's responsibility is fully and clearly established in the mind of the man operating such tools. What he is saying about the tool foreman would, in my opinion, be too spicy to appear in print.

Conditions of this nature cannot generally be charged against the tool foreman because in my experience I never found a real tool man who would willingly allow tools in his cars to get in such condition. In a shop where poor tools are in evidence to any great extent, the responsibility for such conditions generally rests upon the local or general officers. Either they fail to secure a competent tool man who can remedy the situation, or they fail to furnish proper facilities whereby a competent man can accomplish this task.

Many conditions contribute to the responsibilities of the tool foreman. The railroads are still struggling through a period which has demanded the greatest courage and resourcefulness on the part of the executives to meet the demand made on them for handling the country's transportation, without having the power to establish or secure competent returns to cover the ever increasing expense of operation.

In 1923, the railroads of this country attained a record that has heretofore never been approached in the history of transportation. The service rendered measured by the number of tons of revenue freight moved one mile, showed an increase of sixty billion net ton-miles greater than was moved in 1916. In hauling this great volume of business, the net revenue obtained was something like seventy-eight million dollars less than that obtained for handling the transportation business on the railroads in 1916. The year 1924 and the first half of 1925 show a marked decrease in tonnage available, resulting in a greater necessity for added returns to overcome deficits in net earnings in the future.

I touch on this important subject to reflect, if I can, the necessity of every man in all branches of the service realizing his full responsibility, in order that each unit may develop the highest standard of efficiency.

As mechanical men, one of our important problems is to increase the output of shops, roundhouses and repair yards, in order to cut maintenance costs to the very minimum. In this respect, the tool foreman plays a very important part. Assuming the best possible facilities and maintenance forces comprising workmen carefully selected, well organized and properly supervised, it will then depend on an adequate supply of properly maintained tools if our repair costs are to be brought to a minimum. Without sufficient well kept tools, no shop can hope to maintain its share of responsibility in output.

The tool foreman's responsibility rests largely in his ability to organize, develop, perfect and promote the thought, plan, device or organization connected with the successful maintenance of an up-to-date, adequate tool supply. We know that often tool foremen are held responsible for the condition of tools which have long outlived their usefulness. Those of us who have had practical experience realize that the tool foreman is often held responsible for tools which apparently have not held up under the strain or speeds for which they were built, owing to improper heat treatment or carelessness in manufacturing. Often you are held responsible for damage to tools on account of excessive speeds of motors, presses or machines when using drills, taps, dies, reamers, cutters, etc., when in reality the responsibility in these matters rests to a large degree on the lack of co-operation shown the tool foreman when he has intelligently brought the subject to the attention of his superior officer.

To have good tools available at all times requires a definite skilled organization. In this day and age, no man can do all the work or assume all the responsibility. He must of necessity depend upon his associates who comprise his organization and keep before them the motto of this association—"Higher efficiency in the railway tool service."

Chas. E. Helm (C. M. & St. P.)
President

E. A. Hildebrandt (C. C. C. & St. L.)
1st Vice-president

G. G. Macina (C. M. & St. P.)
Secretary

Machine equipment for the toolroom

By C. A. Shaffer

General supervisor of shop machinery and tools, Illinois Central, Chicago

In the apparent increasing tendency toward better and more complete shop machinery and other facilities for making repairs to locomotives and cars, the matter of suitable equipment for the maintenance of all tools with which that work must be done, should not be overlooked.

In the past, it is quite evident that due consideration has not been given to equipping the tool department to the best advantage for making and maintaining in first class condition such tools as may be required. This is true of many shops from the largest to the smallest, and, at the present time, when the importance of good tools is being generally recognized, it may not be amiss to discuss the question of toolroom machinery.

The tool department of any railroad shop should be adequate to maintain all tools used locally or under that shop's jurisdiction properly and economically, and in order to keep pace with improvements made in design, and the increased size of machinery and tools for handling modern locomotives, it is necessary that corresponding attention be given to the equipment for maintenance of such tools.

Obviously, it is impossible to work out a definite list of machinery and equipment which would be practicable to meet requirements for all shops because of the various methods used by different railroads for handling this work, also the kind and amount of work to be done and local conditions governing. Therefore, it would seem desirable to submit possibly three groups of equipment for consideration either separately or in combination of items from one or more groups as may be best suited to meet the requirements of individual cases.

Some of the larger railroads make it a practice to have centralized toolrooms, usually located at their main shops, where certain standardized tools are made for the entire railroad and shipped to the different points on requisition. These are generally known as manufacturing toolrooms,

and require somewhat greater and more diversified lots of equipment than the tool departments where only maintenance or reconditioning work is done.

However, the majority of railroads have tool departments at their main shops where all local tool maintenance and repairs are taken care of, and, possibly, some new work in emergency cases or for occasional replacements.

Group No. 1.—Equipment for general tool manufacturing and maintenance department

Item No.	Nominal size	Type and kind of machine	Special equipment or extra attachments
1	20-in. by 10-ft.	Engine lathe	Taper attachment; 16-in. four jaw independent chuck.
2	18-in. by 8-ft.	Engine lathe	Taper attachment; 14-in. four jaw independent chuck.
3	16-in. by 8-ft.	Toolroom lathe	Taper attachment; draw-in attachment; universal relieving attachment and one universal, and independent chuck.
4	14-in. by 6-ft.	Toolroom lathe	Taper attachment; draw-in attachment; universal relieving attachment and one universal, and independent chuck.
5	10-in. by 4-ft.	Precision tool maker's lathe	Complete.
6	3-in. by 36-in.	Turret lathe	Bar stock and chucking equipment.
7	No. 4	Horizontal, knee type universal milling machine.	
8	No. 3	Horizontal, knee type universal milling machine.	
9	No. 2	Horizontal, knee type universal milling machine.	
10	No. 4 or No. 5	Vertical milling machine.	
11	24-in.	Crank shaper	
12	16-in.	Crank shaper	Universal table.
13	10-in.	Vertical shaper or slotter.	Angle adjusting head; universal table.
14	24-in. by 2-in. capacity	Radial drill press	Reversing attachment.
15	20-in. by 1¼ in. capacity	Upright drill press	Reversible; compound table; universal vise.
16	14-in. by ½-in. capacity	Precision speed drill	With square and round tables; "V" cup and point center.
17	12-in. by 36-in.	Extra heavy duty universal grinder	Internal and radius attachments.
18	10-in. by 36-in. by 24-in. table travel	Medium service universal cutter and reamer grinder	Complete with power and hand feeds with all attachments.
19	8-in. by 24-in.	Automatic wet surface grinder	Universal vise: magnet chuck.
20		Heavy universal tool grinder	
21	¼-in. to 3-in. capacity	Twist drill grinder	
22	Capacity up to 3 in.	Tap grinder	
23	Capacity for all sizes.	Universal die chaser grinder	
24	9-in.	Disc and belt grinder, polisher and buffer	
25	10-in. by 1-in. wheels.	Double floor stand grinder	
26	14-in. by 2-in. wheels.	Double floor stand grinder	
27	Medium size	Floor stand type arbor press	
28	6-in. capacity	Power hack saw	
		HEAT TREATING EQUIPMENT	
29	8-in. by 12-in. by 26-in.	Furnace	Electric or gas.
30	4-in. by 8-in. by 12-in.	Furnace	Electric or gas.
31	10-in. by 24-in.	Crucible	
32	12-in. by 18-in. by 24-in.	Furnace	Auto. electric tempering.
33	24-in. by 36-in.	Oil immersion tank	36-in. by 36-in. water jacket.
		MISCELLANEOUS	
	Air flow meters.		
	Air tool testers.		
	Scleroscope and other measuring or testing instruments.		

In selecting a list of toolroom machinery, there are a number of important points to be considered, the principal ones being: (1) Will manufacturing of new tools be done and if so, what kind and to what extent? (2) Will all classes of work pertaining to the upkeep of tools for every department be performed? (3) Equipment should be practical both as to size and design with a view to future requirements or expansion.

For the above groups, the following machines are suggested. The description of individual items is brief and confined to the kind or type of machine and principal dimensions or features. The maker's name has been purposely omitted. All machines should be individual motor-driven and equipped with suitable push button control. For convenient reference, the machines are classified and listed by consecutive item numbers.

Regarding the first group of equipment in the above list (comprising 33 items), it should be remembered that while the number of machines may appear excessive, an outfit about equal to this would be required to handle properly the work of manufacturing on a paying basis, certain new tools, such as reamers, cutters, taps, forging dies, jigs, fixtures and other special tools in quantities for general use at all shops, in addition to maintaining all local tools. It is believed, however, that the necessity for manufacturing such tools as reamers, taps, drills, threading dies, etc., is diminishing and the possibilities for effecting savings in this line are very remote. This is due to keen competition among commercial manufac-

Group No. 2.—Equipment for medium size shop doing mostly maintenance work

Item No.	Nominal size	Type and kind of machine	Special equipment or extra attachments
1	20-in. by 10-ft.	Engine lathe	Taper attachment; 16-in. four jaw independent chuck.
2	14-in. by 6-ft.	Toolroom lathe	Taper attachment; draw-in attachment, universal relieving attachment, and one universal and independent chuck.
3	No. 3	Horizontal, knee type universal milling machine.	
4	16-in.	Crank shaper	Universal table.
5	20-in. by 1¼-in. capacity	Upright drill press	Reversible; compound table; universal vise.
6	10-in. by 36-in. by 24-in. table travel	Medium service universal cutter and reamer grinder	Complete with power and hand feeds with all attachments.
7	¼-in. to 3-in. capacity	Twist drill grinder	
8	Capacity up to 3-in.	Tap grinder	
9	Capacity for all sizes.	Universal die chaser grinder	
10	14-in. by 2-in. wheels.	Double floor stand grinder	
11	Medium size	Floor stand type arbor press	
		HEAT TREATING EQUIPMENT	
12	8-in. by 12-in. by 26-in.	Furnace	Electric or gas.
13	4-in. by 8-in. by 12-in.	Furnace	Electric or gas.
14	24-in. by 36-in.	Oil immersion tank	36-in. by 36-in. water jacket.
		MISCELLANEOUS	
	Air flow meters.		
	Air tool testers.		
	Scleroscope and other measuring or testing instruments.		

Group No. 3.—Equipment for smaller shop where the only work done is reconditioning of tools generally used on running repair work

Item No.	Nominal size	Type and kind of machine	Special equipment or extra attachments
1	20-in. by 10-ft.	Engine lathe	Taper attachment; 16-in. four jaw independent chuck.
2	20-in. by 1¼-in. capacity	Upright drill press	Reversible; compound table; universal vise.
3	10-in. by 36-in. by 24-in. table travel	Medium service universal cutter and reamer grinder	Complete with power and hand feeds with all attachments.
4	¼-in. to 3-in. capacity	Twist drill grinder	

turers and the fact that several reputable concerns are now listing as standard such tools as were considered special a few years ago and were priced accordingly.

There are many special time-saving tools and devices which had their origin and development in the railroad shop being manufactured and used today, which cannot be obtained elsewhere. These, together with forging and forming dies or other equipment of similar construction, give reason for a full complement of machinery in the tool department of an up-to-date railroad shop.

In the second group (comprising 14 items) is shown such machines as may be considered adaptable for the average medium-size shop to take care of occasional replacements and specialties in the way of new tools and the complete repairs and reconditioning of existing equipment.

The third group (comprising only four items) is suggested for outlying shops to handle limited light repairs to local shop equipment and sharpen such hand tools as drills, reamers, taps, thread chasers and cutters which would otherwise have to be shipped to a larger shop for reconditioning.

Report on shop jigs and devices

If some shop jigs and devices are not direct labor savers, they perform certain operations more uniformly and correctly than would otherwise be possible and therefore help increase the efficiency of shop operation and reduce costs. The jigs and devices shown in the accompanying illustrations have been developed and are used successfully at various points on the Santa Fe, notably San Bernardino, Cal., and Topeka, Kan.

A device for repairing the worn tender conveyor screws of Duplex stokers is illustrated in Fig. 1. The mechanically guided oxy-acetylene cutting torch cuts off the worn part of the top of the screw at a uniform distance from the center line and a steel strip subsequently welded to the conveyor screw brings it back to the standard diameter. Referring to the illustration, it will be noted that the conveyor screw is capable of rotation between centers on an iron frame-work supported on two wooden blocks. A carriage with an adjustable clamping arrangement to hold the cutting torch moves parallel with the center line of the conveyor screw, being guided by four flanged wheels which roll on the bed plate of the device. A vertical projection on the carriage carrying a taper roll at the top governs the horizontal movement of the carriage by bearing on the spiral of the conveyor screw and keeps the torch tip at the proper distance for effective cutting. In other words, starting with the torch at the right end of the conveyor screw, revolution of the screw will push the carriage with the torch attached to the left, the tip of the torch always remaining at the same distance from the spiral which is being cut. The speed of revolution of the conveyor screw is adjusted to that required for efficient operation of the cutting torch.

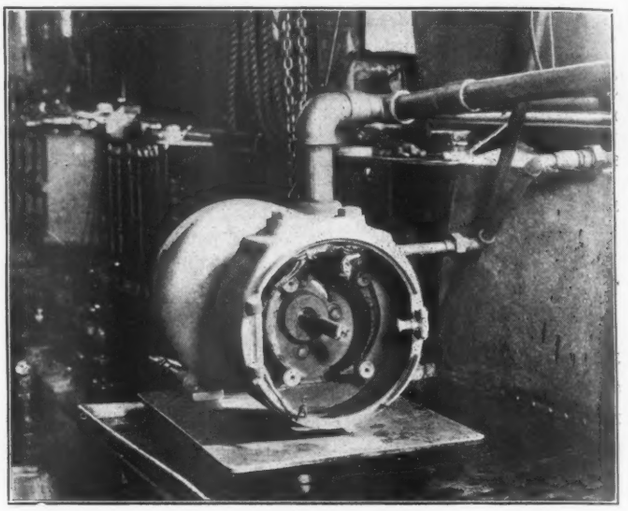


Fig. 2—Turning platform and work bench for repairing headlight turbines

A turning platform and work bench for use in repairing and testing headlight turbines is illustrated in Fig. 2. The platform turns on ball bearings and its use materially facilitates handling the turbines on the bench.

An ingenious and effective drill press clamp is illustrated in Fig. 3, clamps of this type being used on most of the drill presses in the Topeka shops for holding work. Bolts, U-clamps and blocks are largely eliminated, and set-up time is reduced proportionately. The construction of the clamp is plainly shown in the illustration, pressure on the work being obtained by pneumatic pressure in the cylinder, with a taper block on the end of the piston acting on the rigid right angle arm. Two substantial rolls on each side of the taper block reduce friction. A suitable

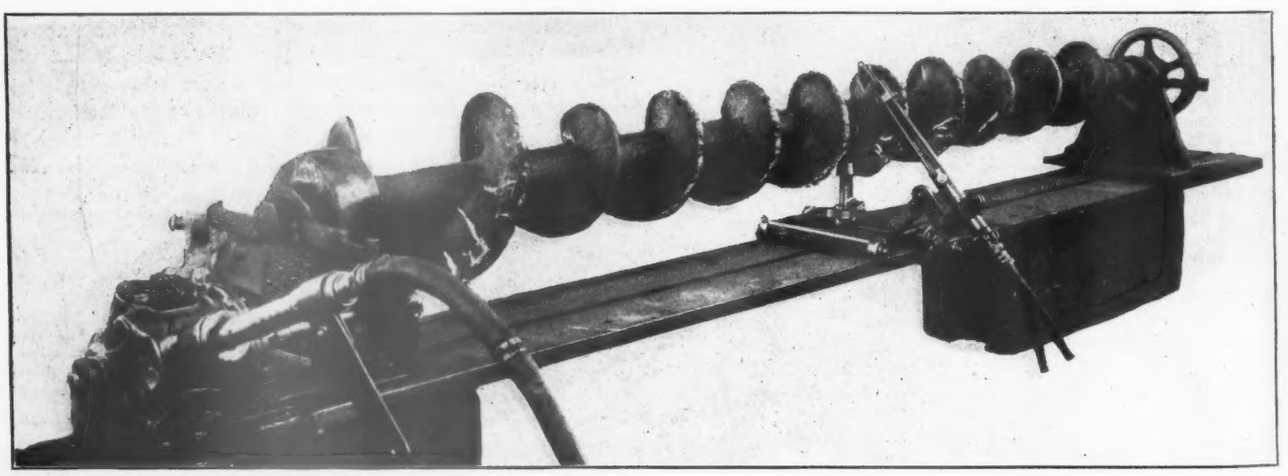


Fig. 1—Device for cutting off the worn part of Duplex stoker conveyor screws

collar and retaining spring keeps the right angle arm up against the heavy 2½-in. nut, out of the way of any work on the drill press table while arranging the set-up.

Another device which assists in handling drill press work is the jig illustrated in Fig. 4. The length of time required for blocking up work at an angle on the drill press table is well known, and moreover, without the

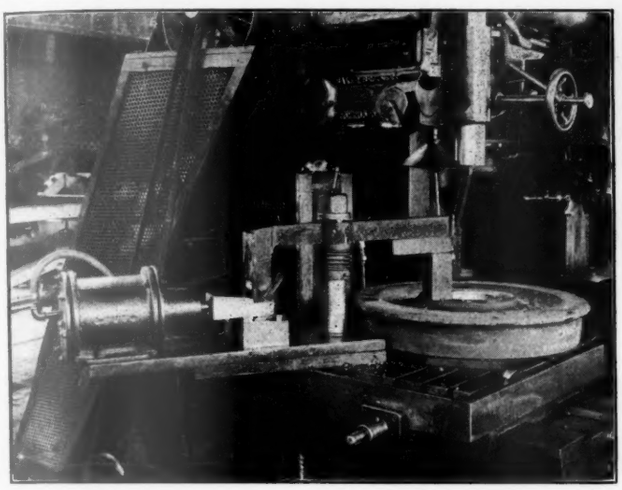


Fig. 3—Set-up time is saved with this pneumatic drill press clamp

exercise of considerable care and skill there is danger of ordinary blocks slipping and resulting in drill breakage. The jig illustrated consists simply of a bracket bolted to the drill press table with an auxiliary table capable of tilting at any angle. For drilling small holes such as oil holes in the spring hangers illustrated, simply tighten the two nuts on the bolts on which the auxiliary table pivots.

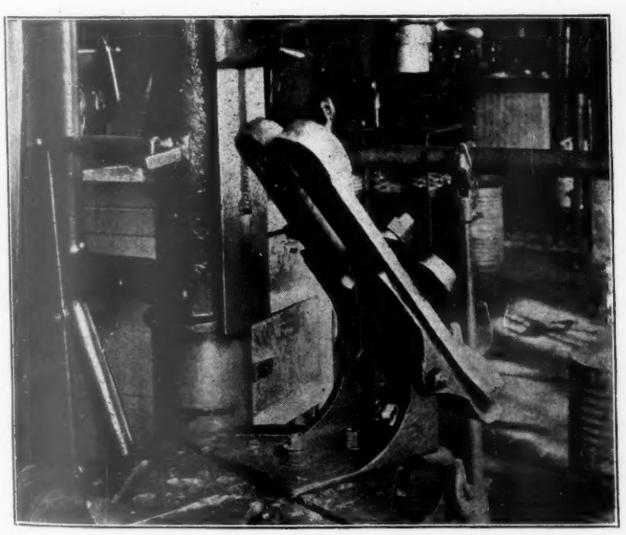


Fig. 4—Convenient drill press jig for drilling oil holes in spring hangers

This will develop sufficient friction to hold the table at any desired angle.

A convenient device for removing gears from a stoker shaft or other similar part is illustrated in Fig. 5. The framework of the device consists of a substantial U-shaped forging with the two ends turned over to form jaws and an accurately-cut 1½-in. screw threaded through a hole in the head of the puller. Any drive or force fit which is within the capacity of the device can be readily broken.

A particular advantage is its portability. It can frequently be used for removing gears in difficult places

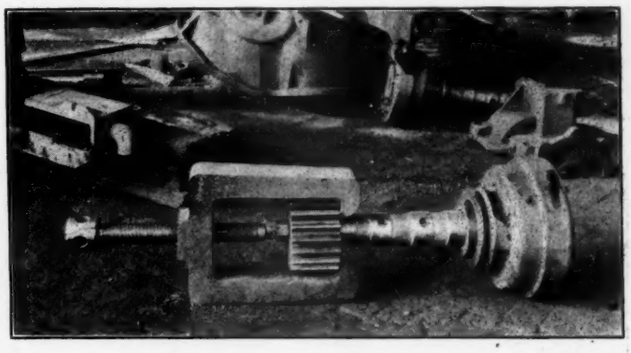


Fig. 5—Screw puller for removing gears from stoker shafts and other similar work

which would otherwise require dismantling the entire machine in order to take the particular shaft involved to the hydraulic press.

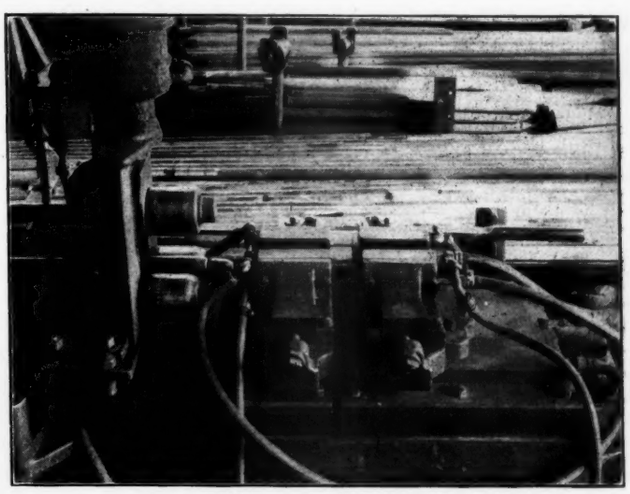


Fig. 6—Three-point roller as applied to modern electric flue welding machine

A three-point flue roller used with an electric welding machine is illustrated in Fig. 6. This device will roll the welds on flues smoother (on the inside as well as the out-

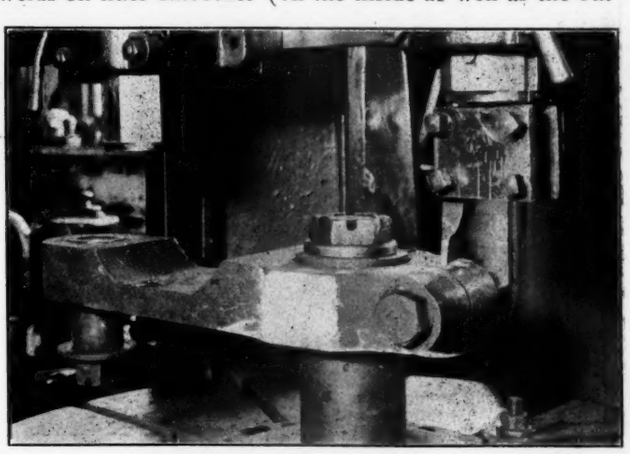


Fig. 7—Jig for holding eccentric crank arm while facing on boring mill

side) and do better work than with the old style roller.

A convenient jig for holding eccentric crank arms while being faced in a boring machine is illustrated in Fig. 7. By means of this jig the crank arm is easily and accurately set.

Some of the simplest shop devices are the ones which in the aggregate prove most effective and the chuck for turning and holding boiler check valves in a lathe, as illustrated in Fig. 8, may be taken as an example. This device permits the valves to be machined accurately and

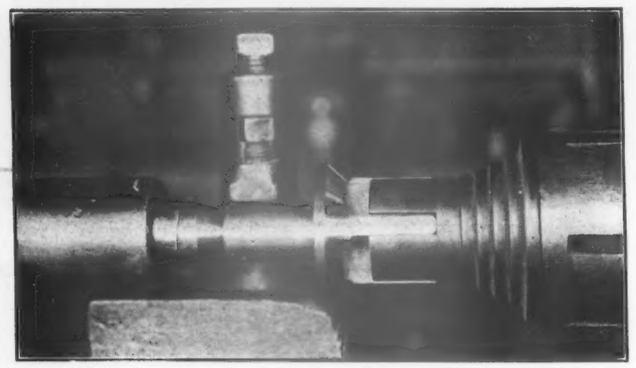


Fig. 8—Special lathe chuck for holding boiler check valves while being machined

in a minimum time. They are easily slipped in place and taken out again at completion.

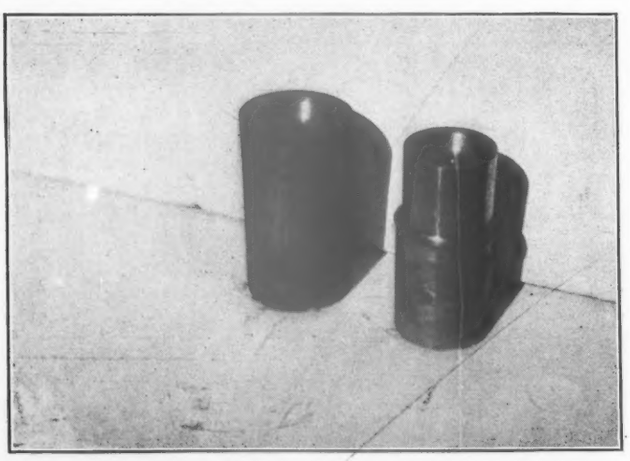
This report was signed by the chairman of the committee, Henry Otto, tool foreman, Atchison, Topeka & Santa Fe, Topeka, Kan., who requested that the association express its appreciation to J. R. Phelps, shop apprentice instructor of the Santa Fe at San Bernardino, Cal., for his able assistance in collecting data and photographs of many of the shop kinks.

Crank pins machined with counterbored ends

By J. Robert Phelps

Apprentice instructor, A. T. & S. F. shops, San Bernardino, Cal.

THE machining of locomotive crank pins in job lots is one of the common jobs in the locomotive repair shop. Considerable time can be saved in these shops by adopting the following methods. The pins are first roughed out on a lathe and are then taken to a drill press where they are drilled and counterbored on both ends. The pins are now ready to be turned according to the sizes furnished by the wheel gang.



Finished and semi-finished crank pins with the ends drilled and counterbored

The lathe operator places the crank pins on the lathe centers in the holes which have been previously drilled in the pins. When the pin is finished, to size, its outside surface is true with the hole and the counterbore and is ready to be pressed in by the wheel press, thus eliminating any waiting at the last minute on the part of the wheel gang for the pins to be drilled. The machining of crank pins in this manner fits in well with the practice of keeping on hand a number of pins and axles all finished except for the wheel fits.

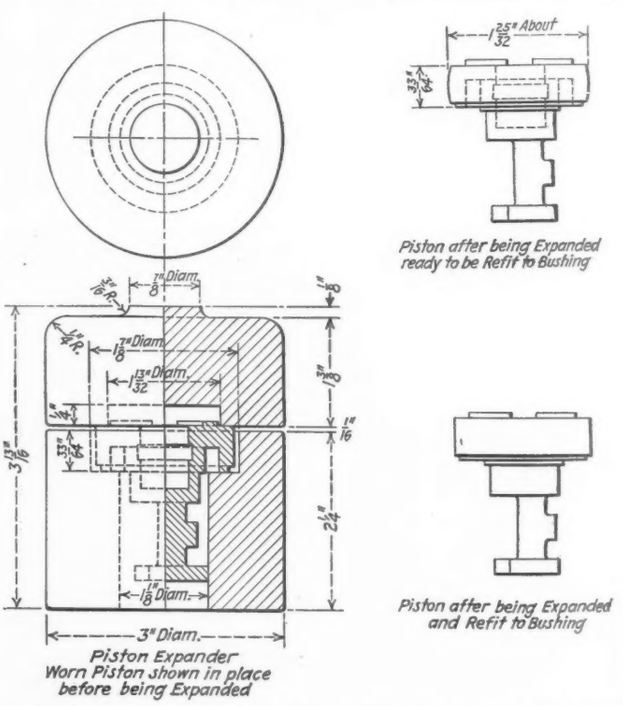
Piston expander for reclaiming feed valves

By N. T. Cline

Air brake foreman, P. & L. E., Pittsburgh, Pa.

THE device shown in the drawing will be of benefit to air brake repairmen who are engaged in the repair and reclamation of air brake material. It has been used for reclaiming worn out *C*-6 and *B*-6 feed valve pistons at these shops for a number of years and has been found to be quite efficient for this work.

The operation of the device is simple and fast. Pistons



Device for reclaiming worn out C-6 and B-6 feed valve pistons

which have been worn down too small for further use are inserted in the device, as shown in the drawing, and the cap is placed on the top. The device is then placed under a hydraulic or air press that has sufficient capacity to force the two parts together. This causes the metal in the piston to expand sufficiently to permit machining to the proper size. The thickness of the piston is slightly smaller after this operation but the difference is so slight that it does not interfere with the operation of the valve. The two operations of expanding and machining take about six minutes.

Annual banquet of the International Railway General Foremen's Association, Hotel Sherman, Chicago, Ill.

General foremen meet at Chicago

Report is made on supervision of repairs to special locomotive appliances—Six other topics discussed

SIX reports were discussed at the nineteenth annual convention of the International Railway General Foremen's Association held at the Hotel Sherman, Chicago, September 8 to 11, inclusive, as follows: Automatic Train Control, Supervision of Repairs to Special Locomotive Appliances, Straightline or Spot System of Car Repairs, What Can the General Foreman Contribute to Obtain More Ton Miles per Shop Man Hour, Reclamation of Car and Locomotive Material, and Best Routing System to Increase Shop Output. A feature of the convention was the address on the third day by Roy V. Wright, editor of the *Railway Mechanical Engineer*, who made a strong appeal for a higher type of leadership in the railroad mechanical field, and pointed out the urgent need of definite plans for building men for the future. An abstract of Mr. Wright's remarks is presented below.

Election of officers

The officers of the association for 1926, most of whom were re-elected, are as follows: President, H. E. Warner, New York Central, Elkhart, Ind.; first vice-president, C. A. Barnes, Chicago & Western Indiana, Chicago; second vice-president, F. M. A'Hearn, Bessemer & Lake Erie, Greenville, Pa.; third vice-president, C. F. Bauman, Chicago & North Western, Winona, Minn. William Hall, Chicago & North Western, Winona, Minn., is permanent secretary-treasurer. William Mulcahy, Baltimore & Ohio, Garrett, Ind., and B. L. Davies, Baltimore & Ohio, Hammond, Ind., were replaced on the executive committee by J. N. Chapman, Illinois Central, Water Valley, Miss., and H. Keys, Baltimore & Ohio, Baltimore, Md.

Leadership—Building men for the future

By Roy V. Wright
Editor, Railway Mechanical Engineer

Many things have happened in the past 10 years which have brought about radical changes in railroad shop methods, practices and administration. The shop crafts strike, for example, in 1922 proved to be a terrible experience for both the men and the managements. It had one lasting and beneficial result. It forced both sides to face the situation squarely and to do some real thinking about their mutual relationships. The year 1922 will in all probability mark the passing of large strikes and lockouts in the railroad field. We are going back into the dark ages when we attempt to settle differences by brute force. There is no winner in such a contest—both sides lose, regardless of which one may come out ahead.

"If a house be divided against itself, that house cannot stand." We are coming into a period of co-operation. The ownership of a corporation or railroad is vested in so large a number of people that the executives act in the capacity of trustees and are just as much employees as are the workers in the ranks. In a very real sense, therefore, the executives and representatives of the managements and the workers are *co-workers*.

We now have several different types of co-operative endeavor in the railroad shops, extending all the way from organized co-operation on the part of the labor unions to various forms of so-called employee representation. All of these methods tend to emphasize the importance of the human element in the organization and to restore to some small degree, at least, that intimate contact between the management and the worker which was lost with the coming in of the present industrial age. Then, too, the limelight has been focused on the keystone of the arch in the organization—those men, foremen and subordinate supervisory officers, who come in intimate contact with the workers and lead them.

The foreman and his training

These foremen have the responsibility of interpreting the policies of the management to the men and in turn interpreting the needs of the men to the management. They hold a most vital and strategic position. It would seem that they should be selected only with the very greatest care and that they should receive a most careful course of training in leadership.

A bright young man oft-times in these days with a high

school training, will go into a shop and spend four years as an apprentice in training to become a mechanic. He has much to learn and at the end of his apprenticeship is still in many respects just a beginner. He does possess a certain degree of manual skill and understands how to operate certain machines and equipment. If he continues to develop, becomes a master craftsman and has a good personality, he may become a gang leader or foreman—indeed, if he is willing to study and work hard and possesses any great degree of executive ability, he may climb far up the ladder of success.

There is no more delicate or complicated piece of mechanism than the human being and no two individuals are alike. Treated and directed rightly, a worker will function with enthusiasm and great efficiency—misunderstood, even to a slight degree, and his efficiency and interest may fall off greatly. Surely, if it takes four years to make a mechanic who must deal with inanimate objects and operate relatively simple machines, it should take years of careful and painstaking work to prepare a man for a position in which he must lead and direct his fellow workers.

How much special training of this sort must a man have to qualify for the position of foreman? You know even better than I do how much he gets. It is, of course, true that certain men are born with the faculty of understanding their fellows and are natural leaders. They are comparatively few in number, however, and even these fortunate ones can benefit greatly by understanding clearly the basic principles upon which successful leadership rests. Not so many years ago people would have smiled if management had been referred to as an art or a profession. Today it is recognized more and more generally as a science.

Have we not a real task before us in training men who must occupy positions of leadership in the future and of helping those who now hold supervisory positions to take advantage of the great amount of information which has been developed in recent years on the art of human leadership?

This information is available for several sources and in different ways, if we will but busy ourselves to take advantage of it. On one road, at least, successful foremen training classes have been conducted under local leadership, but with the aid of a course provided by the extension department of a state university. Other universities have similar courses and I know of at least two different railroad points which are going to put on foremanship training courses this fall with the aid of the state universities.

Then there are a number of roads on which foremen's clubs have functioned. The programs of the staff meetings on many roads have been broadened to include discussions of problems relating to successful leadership. Several correspondence school study courses on foremanship training are available. Some roads believe in sending their foremen and officers to visit shops on other roads in order that they may broaden their ideas and see how other shops are administered. A few mechanical department officers are asking their associates to present written criticisms of articles in the technical papers or reports before railroad clubs or other organization. At least one of these officers is concentrating this sort of a campaign on articles relating to foremanship training. There are other ways in which the foremen are being assisted in getting a better idea of the principles underlying successful leadership, as well as on up-to-date methods and practices. I imagine a most productive session of this convention could be entirely devoted to the exchange of practical experience on this question.

Getting back to the very root of the matter, several mechanical department officers have suggested that the best type of foreman can only be produced by selecting the apprentices with the greatest possible care and then giving them a thorough apprentice training along the lines which have been so well worked out on the Santa Fe. I shall not attempt now, however, to discuss this matter of apprenticeship. For at least a quarter of a century the *Railway Mechanical Engineer* and its predecessors have consistently and aggressively advocated more modern apprenticeship training methods. Some progress has been made in this quarter of a century, but it is only within the past two or three years that the roads at large have shown any very great interest in this question and too many of them are still sound asleep or dozing.

Helping the young men

A splendid movement has been started in the interests of the boys and young men in railroad service. On some roads unusual care is taken in selecting boys for positions in the various departments. On other roads little if any attention is given to this vital question. Even under the best conditions boys are often found in a department or on a class of work who by nature are much better fitted for some other type of work. Some boys cannot be happy or do their best work unless it is particularly adapted to their peculiar abilities. Something must be done to help these boys find the positions in which they can function to the best advantage. More than this, however, any boy can do much better work if he receives the right kind of coaching and encouragement. I am speaking now not of apprentice training, but of the more or less informal contacts with the boys. It is doubtful if any other single investment will mean so much to the railroads in the future as that which can be made by the foremen and supervisory officers, as well as by some of the men in the ranks, in showing a real interest in the boys' welfare and giving them a reasonable amount of encouragement.

The Transportation Department of the Y. M. C. A. held a boys' or younger men's conference in connection with its triennial conference at St. Louis two years ago. An attempt was made at this week-end meeting, which extended over three days, to give the boys some idea of the opportunities for life work on the railroads and to help them find themselves. Briefly, each boy filled out a form answering questions as to the kinds of work which appealed to him, what position he would like to hold ten years from now, etc. On the basis of these answers the boys were divided into small groups, each of which was assigned to the practical railway officer who could best talk matters over with the group and advise the individuals in it. I shall not take more time to explain just how the program was carried on, but it proved so successful that it was found necessary to hold a similar national meeting a year later at Detroit, and a third meeting of this kind is scheduled at Pittsburgh this fall. In addition, one system, the Chesapeake & Ohio, carried out a similar program for its own boys and special care is being given in following this up and getting the foremen and officers to take a larger interest in all of the boys on the system.

After all, the thing that counts in a movement of this sort is the actual concrete results. I know of no way in which these can be better expressed than through the boys themselves. Five months after the Younger Railroad Men's Conference at Detroit, I wrote to all of the boys, asking them if they had received any help or inspiration from the Detroit conference, and whether they had been able to pass this on to boys back home who were unable to attend the meeting. I want to read just a few typical extracts from the letters that I received in reply.

Before doing so, however, just a word about the Detroit conference.

Results of Detroit conference

The Detroit Younger Railroad Men's Conference was attended by 277 boys and young men and 51 leaders. Naturally, a certain percentage of the more ambitious and progressive boys went back home and started something. On the other hand, probably a large percentage of the boys personally profited greatly from the experiences at Detroit, but have not accomplished a great deal for their comrades back home, except that a change in attitude or conduct may have impressed itself upon those with whom they come most intimately in contact. Because the boys were carefully picked, undoubtedly the percentage of self-starters is fairly high.

Undoubtedly, also, the best results in specific communities have been obtained where the community was represented by several delegates. Where only one or two boys have come from a given point, it has been difficult for them to carry back and impress the spirit on their comrades, unless they are of unusual ability. Typical comments follow:

Car repairer apprentice, Boston & Albany.—"I would like to state that from the educational point of view, or in fact from each and any point of view you may look at it, I personally have failed to find the words that will express the great value and helpfulness that I got out of it. It has shown me a different spirit towards my work and also towards my fellow workmen, also a cleaner and better way to live."

Machinist apprentice, Boston & Albany.—"Until the conference, things were sort of dead, but after the conference the fellows knowing the real meaning of service got to work. A greater interest was taken in our Christmas savings clubs. Americanization classes were started and a circulating library commenced. The officials hearing our reports soon understood that we were out to win and all sorts of help followed."

Clerk, Chesapeake & Ohio.—"Since the return of the other boys, we have gotten together and with the help of Mr. Watkins, our Y. M. C. A. secretary, we have organized a club known as 'The Ambitious Club.' The object of this club is to get the younger men and the employers in closer relationship. This club meets at the Y. M. C. A. every Monday night for about one hour and 15 minutes. The meetings are open and the business of the club is discussed. The rest of the time is spent listening to short talks and discussing questions arising in the office and shops with some high employee of the railway company."

Machinist apprentice, Chicago, Rock Island & Pacific.—"Another value is to hear big railroad men talk—not only talk, but get acquainted with them. It's something that every boy and everybody doesn't get a chance to do. You also get acquainted with many railroads, railroads that you never hear about. First thing you'll ask, 'Where is this railroad and how big is it? And what are the apprentices doing?' You learn a lot of those things just from the boys sitting next to you at the dinner table, from the boys who are many miles from home attending the conference."

Machinist helper apprentice, Delaware, Lackawanna & Western.—"That conference has shown me what really great and many opportunities there are in the railroad game. It has encouraged me to study my daily work in the shops with greater interest. It has shown me that my employers are greatly interested in what the young men on our road are doing and that our employers are anxious to help us in our struggle to get ahead. Since the Detroit conference there have been greater activities among us apprentices at the Scranton shops of the Lackawanna."

Machinist apprentice, Lehigh Valley.—"First, it has shown me that the more we come in contact with the big business man, the more we take to him and understand him. Second, it seems as if the work comes easier to us if we have a better feeling toward our employer. One thing I have learned since I came back from Detroit, and which I think the conference was to blame for, and that is not to form an opinion of a person until you have heard some of his good deeds as well as his wrong ones. Because if you stop to think, none of us is perfect. It also proved that to co-operate is to secure benefits for both parties and creates a better feeling between both employee and employer. And that is to get everything out of it you can, especially to find out if you are in the right job. I think this was one of the most important questions asked. Because if you are not in the right job you are discontented and nothing seems to go right."

Sheet metal worker, New York Central.—"Possibly the most individual help was obtained through the Get-Together Meeting. Every young man was given the opportunity to discuss his problems with some older man who was well versed in that particular line of work. Such difficulties as: what a young man could make of himself with his own abilities, how a young man working at a trade which was not adapted to his standard of knowledge or abilities could become a better workman at some other branch of the service and at the same time serve his em-

H. E. Warner (N. Y. C.)
President

C. A. Barnes (Belt Ry. Chi.)
1st Vice-president

F. M. A'Hearn (B. & L. E.)
2nd vice-president

Wm. Hall (C. & N. W.)
Secretary

ployer to a better advantage, were thoroughly reviewed and proved to be possible."

Clerk, Reading Company.—"When we returned home from the conference at Detroit, we decided that we should help the other fellows of our road. As a result of this decision we five who represented the Reading Company at the Detroit conference, organized a younger men's club on our road.

"The club is known as the Reading Company Younger Men's Club. It meets the first and third Friday of each month, in the Y. M. C. A. auditorium.

"The purposes of the organization are as follows: (a) To develop its members spiritually, mentally, physically and socially. (b) To foster and promote a spirit of unselfish service. (c) To assist young men in finding their proper vocation. (d) To promote good fellowship among the younger men of the Reading Company. (e) To promote a spirit of friendly co-operation between employer and employee."

Apprentice instructor.—"Personally, the Detroit conference was the biggest thing in my life and I see the railroad, my work and my boys and superior officers in an entirely different light than formerly. Railroading is no longer just a job, but the most important factor in the progress and development of our country. I do not know of a field that presents such a challenge or opportunity for service, improvement in methods, equipment, development and better human relationships."

Conclusion

I shall let these expressions speak for themselves.

Let us remember that the railroads are vital to the welfare and prosperity of the states and nation. If our foremen and supervisory officers are keen to take advantage of those things that will help them to improve their leadership ability and if we can select, train and inspire the new recruits so that they can find that work for which they are best adapted and in which they can be most happy, then we shall have gone a long way to safeguard the railroads of the future and the best interests of the communities which they serve.

Report on repairs to special appliances

When a booster engine is received at the shop, the engine is placed on a pit and the booster removed for overhauling. The booster binder is taken down and placed low enough to permit the axle gear to pass over, and the wheels to be run clear from the locomotive. After all wheels are removed, the locomotive frame is dropped down far enough to permit the removal of the booster engine by means of a specially constructed four wheel truck provided especially for this purpose. After the booster is removed, it is taken to the booster repair department, where it is placed on horses, at a convenient height for easy access to all parts, the booster resting on the engine bed and axle bearing, keeping the cylinder cock rigging free for testing.

The covers are then removed for washing, and the oil drained off. After it has been washed, each part is removed and inspected. The first part removed is the idler gear, rocker and pin. In most cases the gear bushing has been worn to such an extent as to cause lost motion in the gearing of the booster with the locomotive, and has to be replaced with a new bushing. If the gear is worn more than 10 per cent it is also replaced. It is seldom that a broken rocker is found.

The next part is the clutch cylinder. This is removed from the booster and given a thorough overhauling. Most of the trouble is found with the piston and rings; either, the piston sticks in the cylinder or the rings in the piston. These parts are washed thoroughly with kerosene, and made to move freely. When a clutch cylinder is removed a new gasket should be applied, as when the cylinder is assembled, to be in first-class condition, it must be air tight.

The air lines are then tested in the booster, after which an inspection is made of the pistons and valves. The back heads are taken off and the piston rings examined. In a great many cases it is found necessary to apply new rings.

The valves are then checked up to ascertain if any part of the valve gear is out of line. Sometimes, the valve rocker is found to be bent; in such cases, repairs are made. If everything is found satisfactory the heads are replaced and steam manifold inspected for cracks or steam leaks.

The cylinder jacket is looked over and repaired if necessary. To finish up the back end of the booster, the cylinder cock rigging is checked. In a great many cases the fingers are broken or too short, or the rigging out of line with the cocks, which makes it necessary to take the whole rigging apart for repairs.

When this work has been completed, the swab cups, the piston rods, the valve stems are repacked. An inspection is then made of the crossheads and guides. The crossheads are rebabbitted and machined, and guides are lined up to suit.

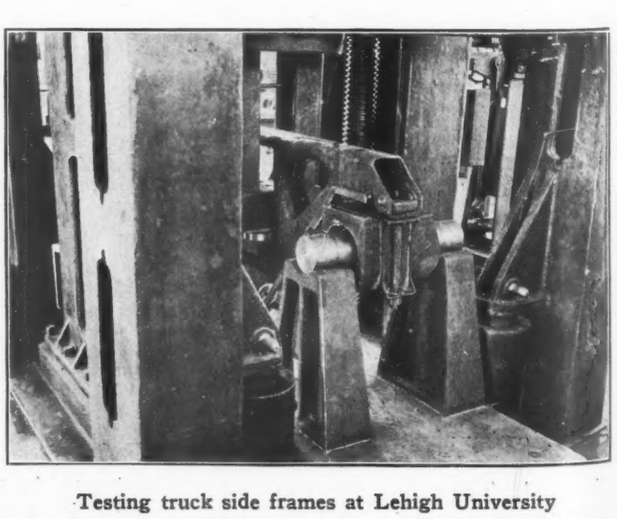
The next operation is the connecting rod bushings. This is a simple matter as these bushings are standard and are easily replaced.

The valve rocker bushing gives very little trouble. If found necessary to renew, it is babbitted and run in. The eccentric crank is next. If any lost motion is found there it must be replaced or a new crank pin is applied. In some cases both parts have to be replaced. The crank shaft and bearings are looked over and if the gear is found satisfactory, bearing caps are adjusted by means of liners being removed. If the gear is worn more than 10 per cent, it is replaced by a new crank shaft, likewise with all other gears in the booster.

When the covers and cylinder jacket are repaired and put back, the booster must be oil tight. The booster binder is replaced and axle bearings inspected. If no repairs are necessary, the booster is ready to be reapplied to locomotive.

The maintenance cost of boosters is low.

The report was signed by the chairman of the committee, R. D. Kocher, Delaware, Lackawanna & Western, Scranton, Pa.



Testing truck side frames at Lehigh University

Blacksmiths' Association Convention

FOLLOWING are abstracts of a number of papers and reports which were presented at the twenty-ninth annual convention of the International Railroad Master Blacksmiths' Association, held at Cleveland, Ohio, August 18-20, 1925. A report of this convention in which abstracts of a number of papers were also given appeared in the September, 1925, issue of the *Railway Mechanical Engineer*, page 575.

Drawbars and pins

By John P. Reid

Master blacksmith, Missouri Pacific, Kansas City, Mo.

All drawbars and safety bars are manufactured from hammered iron furnished from specifications drawn up in the office of the engineer of tests. The practice of closing the pin holes and shortening the draw bars has been discontinued on the Missouri Pacific. When a bar becomes worn in the pin holes, it is scrapped and manufactured into spring hangers or other parts.

We punch the pin holes on all drawbars used on our switching power and preheat when the bars are completed so as to remove all hammer strains that may have been set up during manufacturing. Too much care cannot be given the forging of draw bars. A "pull over" or "cold sheet" may be the cause of a heavy loss to the company. We drill the pin holes on all drawbars and safety bars on our heavy power, both freight and passenger, and preheat when completed which, I believe, goes a long way toward eliminating drawbar failures.

Since we have discontinued shortening, slabbing and closing the pin holes and replacing with new bars, a drawbar failure is a very rare thing. We are eliminating the offset drawbar. We all know that offset drawbars do not give the forging a fair trial. The offset is liable to cause a separation in the structure that cannot be seen with the eye and a surface crack will appear in due course of time. The inspector may or may not see it and the ultimate result is a drawbar failure.

The new power being purchased by the railroads is heavier and the best hammered iron is none too good for drawbars. We also use double refined iron for drawbar pins which comes in dimension lengths. The pins are headed and pointed and punched for a split key on a forging machine. We are not allowed to upset any pins to take care of worn parts. We replace with new pins and use old pins for other repair purposes such as boiler lugs, braces, etc. We do not allow any quenching of drawbars or pins at any time. This is a dangerous practice.

Reclamation

By Frank Laukat

Blacksmith foreman, Oregon, Washington Railroad & Navigation Company, Portland, Ore.

We know that tire steel makes good shear blades, reamer extensions and forging machine dies, and through the co-operation of the tool room foreman it can be used extensively with good results, with the exception of handle punches and side sets. When one considers the cost of making the latter and the danger in using them when made of tire steel, I feel that it will not take any one long to disapprove of such a practice.

We make piston nuts from scrap steel hollow locomotive axles by drawing them down to a hex bar about 8 in. long, letting the hole close as it will and then annealing. The bar is then taken to the machine shop where it is sawed up to proper lengths and the nut is ready for drilling and threading. We also make dry pipe sleeves and flue sheet rings from hollow axles by cutting them up at the cold saw to proper lengths and then drifting them out on the hammer. The steel in these axles is good and we have no trouble in drifting them.

All piston rods are made from scrap steel car axles. Taylor iron locomotive axles are usually saved for drawbars, and I do not know of any material on hand at the railroad shops today that is more suitable for that purpose.

Heat treatment of steel and iron

By Frank Sillix

Master blacksmith, St. Louis-San Francisco, Springfield, Mo.

The first step in annealing always consists in heating the metal past its critical temperature, because by so doing the existing structure, however coarse, is destroyed. Should the temperature of the steel remain below its critical range, no structural change would take place and the annealing would not be effective, except in cases where it is simply desired to remove strains produced by cold working. Strains can be removed in this case by heating to slightly below the critical range. This, however, has no effect on the grain size. On the contrary, should the temperature of the metal be carried considerably above its critical range, the structure of the metal, which was finest within the critical range, begins to coarsen on further heating and continues to grow as the metal cools slowly back to the critical range, so that a coarse structure is the final result. In order to anneal steel properly, it must be heated through its critical range and kept at a temperature as close to the upper part of that range as possible. The annealing temperature will vary with the carbon content, so the greater the carbon content of a steel, the lower will be its critical temperature.

The temperature at which these structural changes occur in steel is not absolutely fixed for any given carbon content, on account of the fact that this temperature depends somewhat on the rate of heating. It follows that there is a range of temperature in which these effects take place, rather than one single temperature. The words "critical range" are used to express the temperature range within which the structural changes outlined above take place.

The following ranges of temperature are recommended by the American Society for Testing Materials:

Range of carbon content, per cent	Range of annealing temperature, deg. F.
Less than 0.12	1610 to 1700
0.12 to 0.29	1540 to 1600
0.30 to 0.49	1500 to 1545
0.50 to 1.00	1455 to 1500

The locomotive forgings which we receive for rods, crank pins, driving axles, etc., and the billets received for the same purpose, have a carbon content of from 0.52 to 1.38 per cent, usually nearer the upper figure. An annealing temperature of 1,490 deg. F. to 1,530 deg. F. would, therefore, be correct for this class of work. Steel castings require a somewhat higher annealing temperature than forgings as the structure of a casting is more difficult to break up. The steel castings which we receive contain about .30 per cent carbon and should be annealed at about 1,650 deg. F.

The steel should be kept long enough at the annealing

temperature to be heated entirely through to that temperature. An exposure of 45 min. for each inch of thickness of the heaviest portion of the forging is recommended. For steel castings, an exposure of 60 min. per inch of thickness is desirable to secure thorough refining of the grain.

The hardness and strength of the steel depends upon the rate of cooling from the annealing temperature. Rapid cooling, as by quenching in oil or water, gives a hard metal which is somewhat brittle. Slow cooling, as in the furnace, gives the maximum softness and ductility at the sacrifice of a certain amount of strength and elasticity. Cooling in air gives properties between the two extremes.

The lower the carbon content, the more quickly may the steel be cooled without affecting too deeply the ductility and hardness of the metal. For instance, steel containing not over .15 per cent carbon may be quenched in water and still remain soft and ductile, while a medium carbon steel forging, say from 38 per cent to 52 per cent carbon must be cooled in air or in the furnace, for if quenched it would be too hard and brittle.

Since large objects cool more slowly than smaller ones under the same conditions, it is evident that the conditions of cooling should also be regulated in accordance with the size of the object. If a large and a small piece of steel of the same carbon content were heated to annealing temperature and then removed from the furnace and cooled in air, the smaller piece will be the harder of the two, since it will have cooled more rapidly. Locomotive forgings of fairly large size, such as rods, piston rods, and large crank pins, should be cooled in air rather than in the furnace, as this will produce a somewhat stronger steel, while, on account of their size, they will not cool rapidly enough to make the steel hard.

If the steel is heated above its critical range while in the annealing furnace, the grains grow in size and the steel is thereby weakened. If the steel is heated to several hundred degrees higher than its critical range, the grains grow to a very large size, producing a very weak and brittle metal, which may break when subjected to a slight shock. Since the growth of the grains takes an appreciable time, it follows that the longer the steel is held at a temperature above the critical range, the larger will the grains become.

Steel which has been overheated in the annealing furnace has a structure very much like that of a steel casting as removed from the mould, being weak and brittle. The overheated steel can be restored by allowing the steel to cool to room temperature, and then reheating to the proper annealing temperature, holding it at this temperature for sufficient time to permit the coarse structure to be completely destroyed, and then cooling as usual. If the steel has not been burnt, this treatment will completely restore it.

From what has been said above regarding the influence of temperature on the properties of steel, it will be evident that accurate means of measuring the temperature of the work in the furnace are absolutely necessary for proper annealing. This measurement of temperature can only be done by suitable pyrometers, which should be frequently checked for accuracy of reading. Most pyrometer installations in annealing furnaces indicate the temperature of the furnace and not the temperature of the work. These two temperatures are not necessarily the same, since the work lags behind the furnace both on heating and cooling.

It goes without saying that the heating of the steel must be as nearly uniform as possible, as otherwise there will be differences in the structure of the same piece and the possibility of strains being set up. The same applies to the cooling from annealing temperature.

Steel forgings of medium carbon should be annealed in all cases after forging, bending either hot or cold, or after any form of cold working. They should also be annealed at intervals during use, especially if they are subjected to heavy working stresses, as annealing removes the effects of fatigue. Annealing should also be given to all medium carbon steel parts which have been built up or otherwise repaired by any form of welding, as well as those cut by means of the oxyacetylene torch. The intense localized heat of welding or gas cutting produces a strained condition in the metal adjoining the weld or cut which is very likely to result in cracks if not removed by annealing.

In annealing, iron should be heated to about 1,250 deg. F. just so it will relieve the stress on the iron if there is any present.

Discussion

The importance of proper heat treatment of iron and steel in the railroad blacksmith shop was emphasized by many of those present. The old haphazard method of hardening by quenching was generally condemned and it was agreed that the analysis of the steel should regulate the heat treatment. A much better job can be obtained if a part is annealed or normalized after it has been forged or hammered. Normalizing seems to get better results than quenching.

One of the speakers brought out the fact that placing cold billets in a hot furnace causes the outside portion to break away from the center. This is caused by the billet heating too rapidly so that the outside portion becomes hot while the inside is still cold. The rapid heating changes the content of the outside surface and in order to prevent this occuring, billets should be preheated before being placed in the furnace. Some blacksmith shops make it a practice to heat billets over night. In such instances, the billets are placed in a cold furnace and it is then brought up to the critical temperature. All furnaces should be equipped with pyrometers.

Pieces eight inches in diameter should be heated ten hours, plus four hours. The four hours is required for heating and the ten hours for normalizing.

Frame making and repairing

By William Banks

Master blacksmith, Yazoo & Mississippi Valley, Vicksburg, Miss.

Frame making is practically a thing of the past at our shops, as all new frames applied at the present time on locomotives are of cast steel. We have not made frames in the blacksmith shop for several years and, I believe, about all of the other railroads are doing likewise. But, for the benefit of those that are still making frames in the smith shop, I will endeavor to explain the method we used in making locomotive frames.

We slab scrap iron axles which are heated in an oil furnace. After these axles are slabbed in billets from sizes six inches to eight inches square, the billets are heated in a furnace and the pedestal jaws, both top and lower, are blocked into sizes suitable for the frame. After this operation, the front and back pedestals are welded to the top and lower rails. These welds are made in the forge, after which these sections are welded together between the pedestal jaws which completes the frame. It is essential to keep the frame straight at each weld made and also to expand the lower rail after the last weld is made so as to avoid undue strains which originate from contraction. When new sections are required they are welded on in the smith shop. Also all frames that have been welded by the autogenous process are then taken

down, the welds removed and new sections are welded in at the smith shop. This only applies to locomotives that are in for general or classified repairs.

In regard to repairing frames, we use both the acetylene and electric process and have experienced very good results. But we all know it depends on the operator as to the kind of a job we get. If a frame is not welded properly in the smith shop, it will not hold up.

Tools and formers

By S. J. Uren

Blacksmith foreman, Southern Pacific, Sacramento, Cal.

Tools and formers are a necessity and no blacksmith shop can get along very well without them. If you have a steam hammer, hydraulic forge press, forging machine, bulldozer, air bending machine, or even an anvil in your

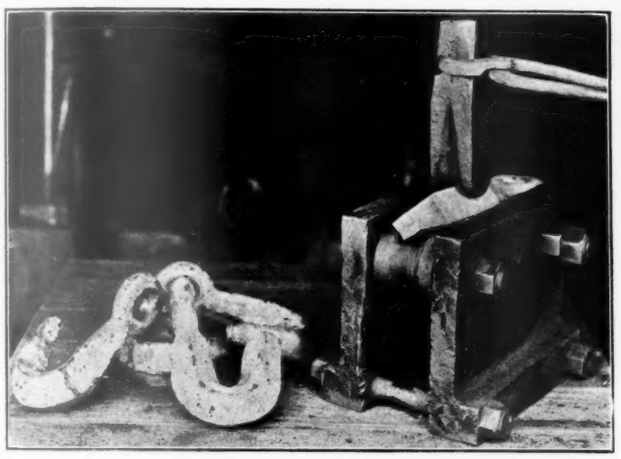


Fig. 1.—Formers for shaping wrecking chain hooks on a steam hammer

shop, what good are they to you unless you have tools and formers. In this connection I will describe some of the tools and formers used in the forge shop of the Southern Pacific, Sacramento, Cal.

In making wrecking chain hooks, a piece of mild steel

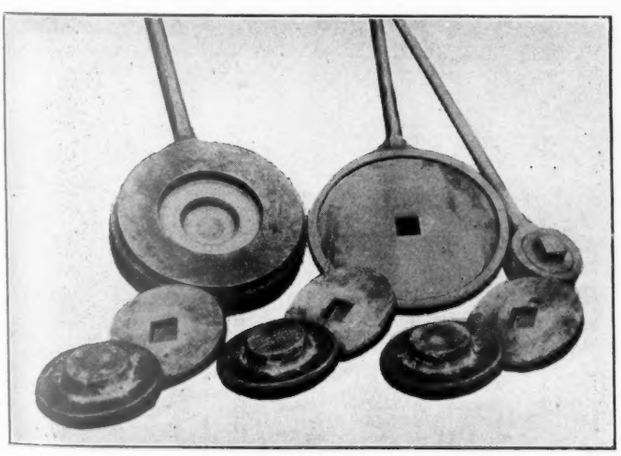


Fig. 2.—Dies for forming side rod collars

two inches square, is cut 11 in. long. The eye is formed in an eye forming tool placed on the steam hammer and the other end is slightly tapered. It is then heated the entire length and placed in the grooved rollers of the tool shown in Fig. 1. The top tool is then placed in the center as shown and a few blows of the steam hammer bend and press the piece down between the two grooved rollers and the hook is completed.

Side rod collars are made in a simple tool placed on the die of a forging press. A piece of four-inch mild steel is heated and placed in the tool. The ram on the forging press is then lowered on the material which easily presses it into shape in the tool shown in Fig. 2. The cap or gage is placed on top of the tool for the marking of the square hole in the center of the collar. The cap is then removed and a 1¾-in. square hole ⅞ in. deep

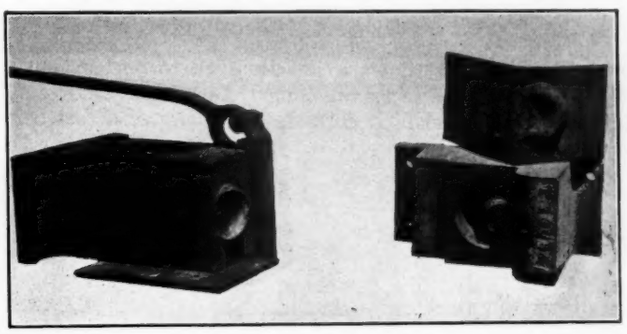


Fig. 3.—Bulldozer dies for manufacturing push pole corner irons

is pressed in the collar which is then completed. This tool can also be used on the steam hammer to good advantage if you have no forging press in your shop, but the collars are pressed into shape much easier with a press than from blows of a steam hammer.

The bulldozer is a handy machine to have in a shop where there is a large quantity of bending and forming to be done, such as arch bars, drawbar yokes and pressing of sheet steel into various shapes that are now being used on modern freight cars. Push pole pockets for

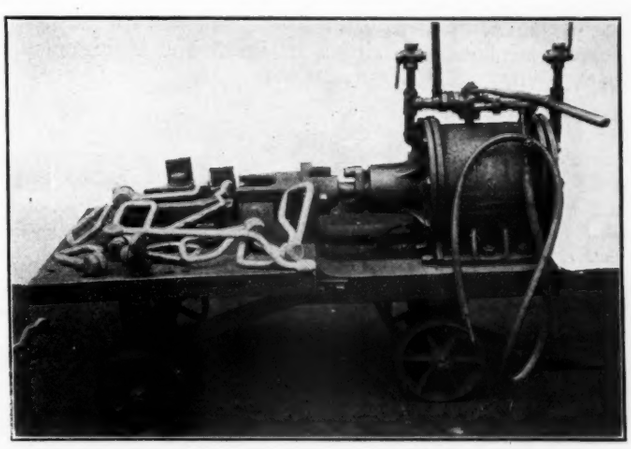


Fig. 4.—Former for offsetting and shaping brake hangers

freight cars are easily made on a bulldozer with the dies shown in Fig. 3. The female former is bolted to the movable face of the machine and the male former is bolted to the stationary face. The material is then placed on a rest on the male former and held in place with a hinged clamp bolted to this former. The female former moves forward making the impression in the pocket and bending the material at right angles at the same time the impression is made.

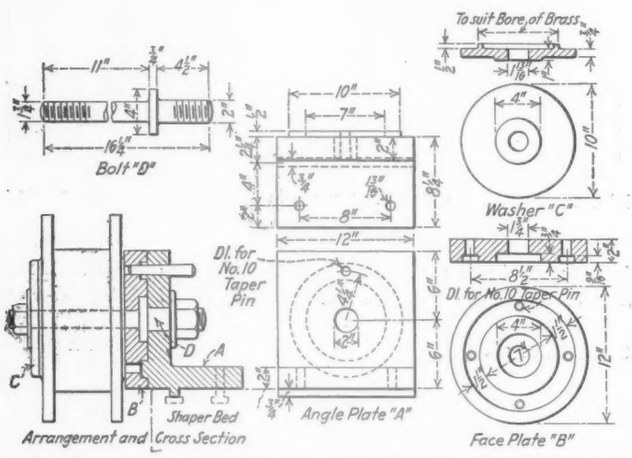
Brake hangers are easily bent to shape in formers attached to the small bending machine shown in Fig. 4. The ends of the brake hangers are first upset on a forg-

ing machine. They are then heated the entire length, placed in the lower part of the former on the bending machine, which is cut out to give the hanger the proper offset. The offset is pressed into shape and the material raised to the upper part of the former. The "U" shaped former which is attached to the piston comes up and bends the hanger to the proper shape on the stationary former which is bolted to the macine.

Jig for finishing rod brasses

By E. A. Miller

THE drawing shows a jig designed to be used on a shaper table when finishing the channels of driving boxes to fit the rods. It consists essentially of a cast iron



Jig used on a shaper table for machining the channels of rod brasses to fit the rods

angle plate with a rib to fit in the bolt slot of the table. The angle plate has a ring 7 in. inside and 10 in. outside diameter protruding from the side ½ in. The face plate *B* is made in the shape of a disc 12 in. in diameter and has a recess bored 9/16 in. deep in the face into which the protruding ring of the angle plate fits. This ring has four holes drilled as shown in the drawing and reamed for a No. 10 taper pin. One hole is drilled in the angle plate to permit the taper pin to be inserted through the angle plate into the face plate. Care must be taken when drilling and reaming the dowel pin holes to have all the holes in the ring fit square with the hole in the angle plate so that the pin will provide the same spacing for all four positions.

Referring to the arrangement drawing, after the top side of the box has been finished, the dowel pin is removed, the box is rotated 90 deg. on the bolt *D* and the dowel pin is inserted again. After the side of the box has been finished to fit the rod, the pin is again removed and the box is rotated to position for machining the other side.

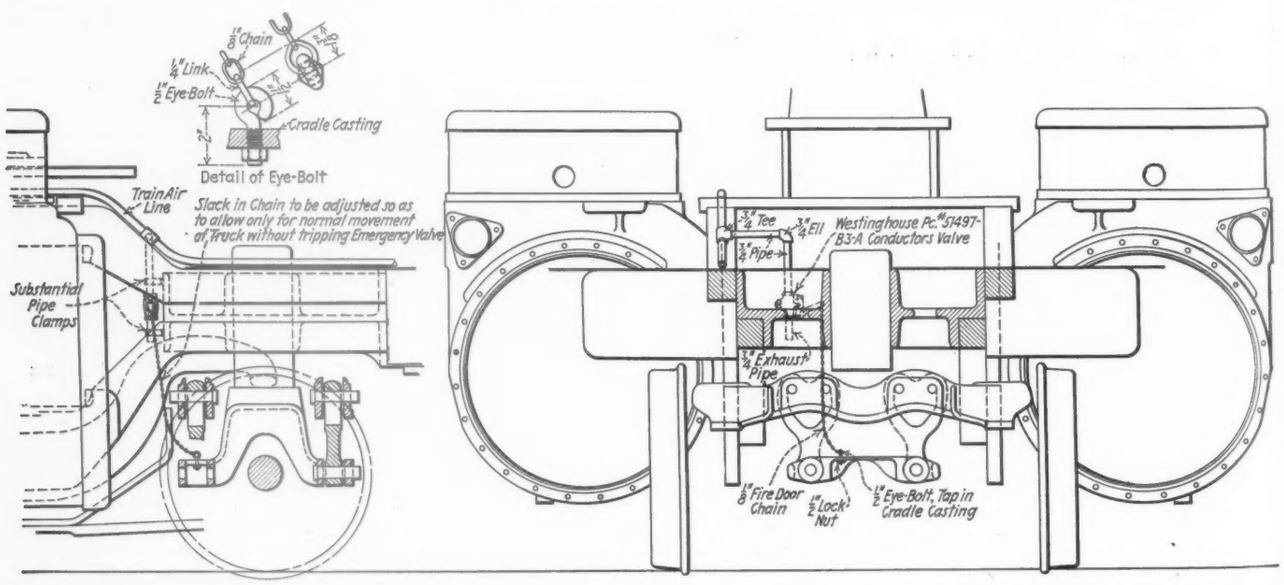
This type of jig, only of smaller construction, can also be used for front end brasses that have been made in halves and sweated together.

Emergency brake for Mallet engine trucks

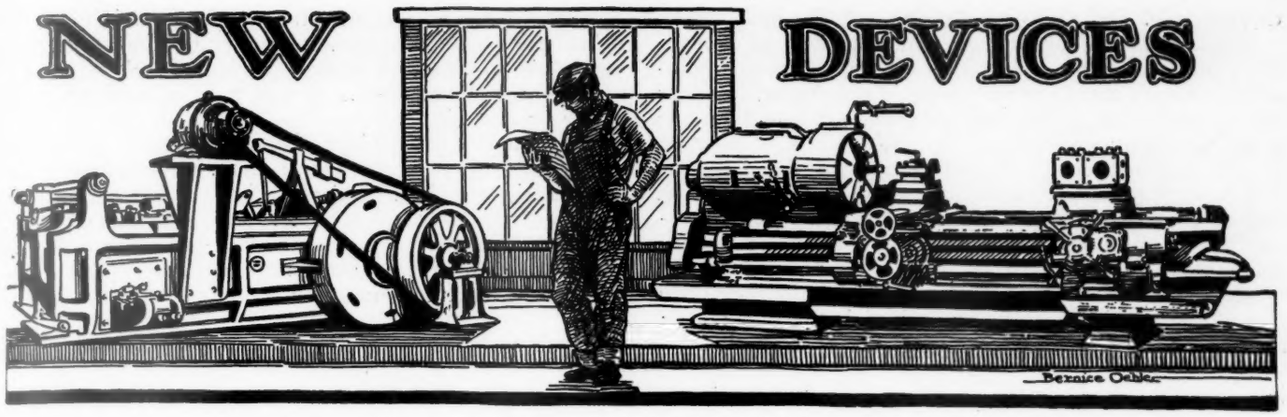
By H. C. Gillespie

Master mechanic, Chesapeake & Ohio, Huntington, W. Va.

IT is usually a difficult matter for an engineman running a Mallet type locomotive to detect the derailment of an engine truck. Sometimes when such derailments occur, the locomotive will be run for miles with the engine truck wheels on the ground unless they strike a cross-over or switch. When this happens, the entire locomotive is sometimes derailed with a possibility of a serious accident. In order to eliminate this danger, an emergency brake valve has been developed on the Chesapeake & Ohio which is to be applied to all Mallet locomotives. The operation of this emergency valve is simple. It consists essentially of a Westinghouse conductor's valve which is connected by a ⅛-in. fire-door chain to the engine truck rocker connecting link. The slack of the chain is adjusted to allow for normal movement of the truck without tripping the emergency valve. The instant the wheels leave the rail, however, the valve is pulled open by the chain which results in setting the brakes.

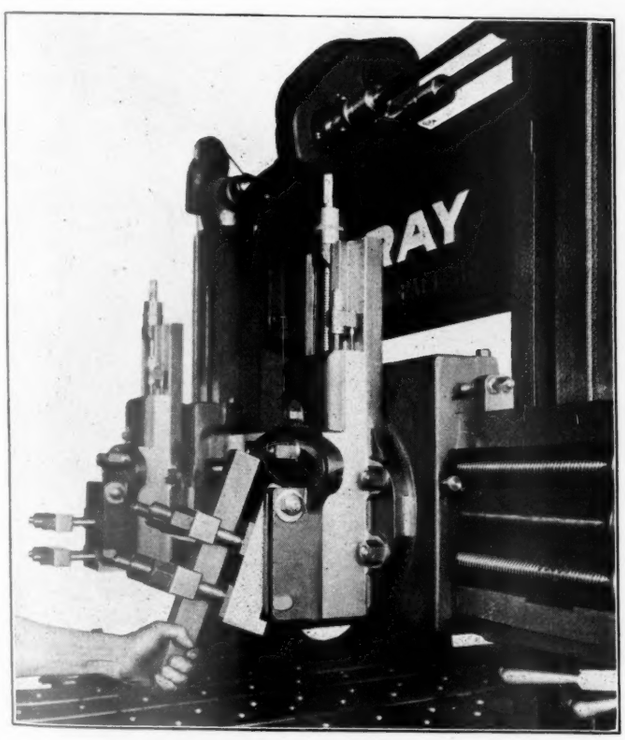

⅛" Chain
¼" Link
½" Eye-Bolt
Cradle Casting
Detail of Eye-Bolt
Train Air Line
Slack in Chain to be adjusted so as to allow only for normal movement of Truck without tripping Emergency Valve
Substantial Pipe Clamps
¾" Tee
¾" Ell
Westinghouse Pc. #51497-B3-A Conductors Valve
¾" Pipe
¾" Exhaust Pipe
⅛" Fire Door Chain
½" Lock Nut
½" Eye-Bolt, Tap in Cradle Casting

Emergency brake valve applied to Mallet engine trucks to reduce the danger of a serious accident as the result of a derailment



Openside planer with simplified control

AN openside planer built in 36-in., 42-in., 48-in., and 60-in. sizes has been recently placed on the market by the G. H. Gray Company, Cincinnati, Ohio. Recognizing the fact that openside planers are often used for very heavy work, and are therefore subjected to heavy cutting strains, the usual design of the column and knee has been departed from in order to make these parts heavy, and of unusually rigid proportions.



Head of the Gray planer showing the abutment apron and the twin-purpose taper gibs

This is evident from the fact that a 36-in. planer of this type has taken cuts with 3/16-in. feed, 1 in. deep in forged steel.

As the column is subjected to severe twisting strains it has been made triangular in section. Such a column is stiffer than the usual column of rectangular section because its walls are directly in line with the forces to be resisted, and there can be no yielding at the corners. A wide column face provides adequate support for the side head, even when long-reach tools are used. Heavy internal braces cast integral with the column add to its rigidity.

The bed of this machine not only has four vertical walls but is cast solid across the bottom under the gears and a heavy brace runs across the top of the bed directly under the cutting tools and the rail. This rigid structure eliminates vibration at this important point in the machine. The remainder of the bed is cast solid on top. The bed is planed on the bottom for ease of leveling and to relieve internal strains in the casting.

The heavy outer wall of the bed extends up on the side of the column to the level of the top of the table so as to support the column as high up and as near to the rail as possible. In addition a heavy tongue and groove, planed into the column and bed, with a metal-to-metal fit, fastens the column and bed together. No part of the bed or the drive mechanism extends below the floor-line, thereby making it possible to install the planer without providing special pits for the gear train or drive mechanism.

The gear train is similar to the helical gear train which has for years been a part of the Gray Maximum service planer. The gears and table rack are cut from steel forgings. They are helical throughout, including the bull gear and table rack, assuring the smoothness and the strength of the helical tooth.

A novel feature is the design of the bull gear which offsets the pressure of the tools on the work by exerting a side thrust on the table. The tools are usually fed away from the operator so that he can see the surface resulting from the cut, and the bull gear tends to push the table in the opposite direction. This materially decreases the tendency of the table to lift under a heavy cut. To still further reduce it, the bull gear teeth are designed with a nine degree pressure angle, so that the force exerted is very nearly horizontal, eliminating the usual vertical thrust. The Gray tooth form also provides a maximum of action in the arc of recess, rather than in the arc of approach, the teeth being of true involute form with long addendum pinions. The continuous rolling contact thus assured is not only of importance in getting fine finishing cuts but also ensures a steady flow of power for the heavy roughing cuts.

The gear train runs in a bath of filtered oil, and the side thrust bearings of bronze provided on each shaft in a flood of oil, as the upward pressure on the gib may, at bearings. This cascade of oil reduces the wear on the

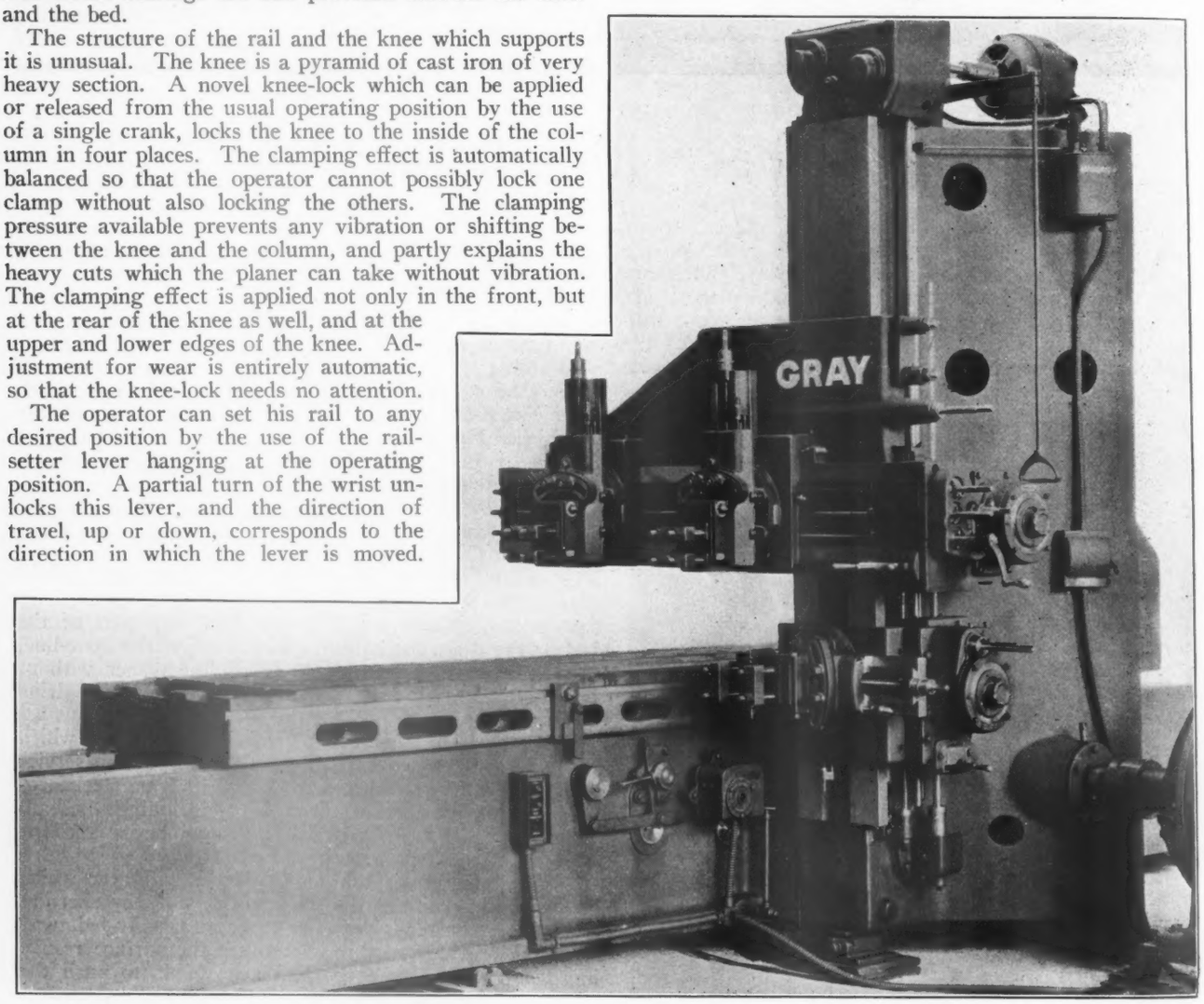
driving train and cushions the teeth of the gear trains.

The necessity of planing overhanging castings of awkward proportions has induced the builder to provide hold-down gibs not merely at the center of the stroke, but over the entire length of the bed and table. Thus, tilting is prevented in any position of the table. The oil pumped to each V flows over the hold-down gibs, so that they run in a flood of oil, as the upward pressure on the gib may, at times, be almost as great as the downward pressure normally exerted on the vees. If it is necessary to remove the table, these gibs can be disengaged from the table without running it off the bull gear. Automatically oiled side thrust bearings are also provided between the table and the bed.

The structure of the rail and the knee which supports it is unusual. The knee is a pyramid of cast iron of very heavy section. A novel knee-lock which can be applied or released from the usual operating position by the use of a single crank, locks the knee to the inside of the column in four places. The clamping effect is automatically balanced so that the operator cannot possibly lock one clamp without also locking the others. The clamping pressure available prevents any vibration or shifting between the knee and the column, and partly explains the heavy cuts which the planer can take without vibration. The clamping effect is applied not only in the front, but at the rear of the knee as well, and at the upper and lower edges of the knee. Adjustment for wear is entirely automatic, so that the knee-lock needs no attention.

The operator can set his rail to any desired position by the use of the rail-setter lever hanging at the operating position. A partial turn of the wrist unlocks this lever, and the direction of travel, up or down, corresponds to the direction in which the lever is moved. This counterbalance offsets the overhung weight of the knee, relieves the rail-elevating screw of binding strains, eliminates cocking and binding, and thus makes it easier to raise and lower the knee and rail, in spite of their massive proportions.

To set a head into place, the operator need only give one push to the rapid traverse lever. These levers are mounted in the right hand end of the rail, and this one motion of the lever suffices to start the motor in the right direction, disconnect the crank to avoid accident, and disconnect the feed mechanism. Putting the lever back into the "off" position automatically reconnects the power feed



Front view of the Gray openside planer—all controls are centered in the right end of the rail, although a tumbler lever is provided on the other side of the bed for emergency use

As the rail does not drift when the lever is pushed into the "off" position, the operator can set it to a line and is encouraged to bring it down close to the work. This eliminates the tendency to take a long reach with the cutting tool, and enables the operator to take heavier cuts, and produce work free of chatter marks.

An entirely new device on this type of planer is the Gray ball bearing, spring counterbalance. A ball-bearing roller is mounted at the right hand end of the rail at the top. Heavy springs force this roller against the right hand edge of the column face, thereby keeping the rail and knee snug against the column even when unclamped.

to the head and reconnects the manual crank. By this control the operator can quickly jump over an air gap in his job without "cutting air" for several strokes with the power feed. One rail head can be moved into place while the other is cutting, without interference. Similarly the slides can be moved up and down by rapid traverse. The Gray safety clutch disconnects the traverse motor and relieves the mechanism of all strains in case one head strikes another, or if the slide, in being moved downwards, goes too far, so that the tool strikes the bed of the table or the work.

The side head, when furnished, has its own rapid tra-

verse lever which is entirely independent from those provided on the rail. It also has its own feed dial.

On these planers the tool aprons are provided with an abutment or shoulder across the lower end. This prevents springing of the apron under the strain of clamping the tool. It bears against a corresponding surface on the lower end of the tool box, so that the upward thrust of the cutting tools comes on this abutment and not on the taper pin.

The table is of box-section, with heavy internal walls. One of these walls runs the full length of the table directly under the center T-slot, so as to tie the top and bottom plates together and prevent springing. This provision is supplemented by the double length bed; the table never overhangs, even at the extreme end of a stroke.

The "Cantslip" feed is a positive feed, not being transmitted through frictions. This ensures that the operator will get exactly the feed for which he has set the dial. The dial is self-locking, and is graduated in thousandths of an inch. A partial turn of the wrist automatically unlocks the dial and permits it to turn to any desired feed between zero and one inch, in steps of .01 in. The same type of feed is provided on the side head. A safety clutch instantly relieves the mechanism of strain should one head be allowed to feed into the end of the rail, or against the other head.

On this planer the oiling has been made as automatic as possible, not only by a continuous flow of oil to the V's, side thrust bearings, hold down gibs, gear train and shaft bearings, but by the provision of centralized oilers on the rail, rail heads, side head and column. The traverse motor requires no attention, as it runs on ball bearings in grease and drives the gears which run sealed in an oil case, mounted on ball bearings. It is recommended that the centralized oilers be filled once a week, a task that requires only five minutes. The oil under the gears, which passes through a filter, strainer and settling basin on each journey through the machine, need never be removed as it is automatically clarified and cleaned. The dirt taken out of the oiling system gathers in a pocket at the end of the bed, conveniently located for cleaning out.

The machines can be arranged for self-contained countershaft drive, motor drive with motor mounted directly on the column, or for reversing motor drive.

Wheel dog for changing journal brasses

IN order to replace the bearing in a hot journal box some way must be found to hold the wheel firmly to the rail. The wheel is generally held down either by placing blocks or wedges between the top of the wheel and the bottom of the car, or by first jacking up the body

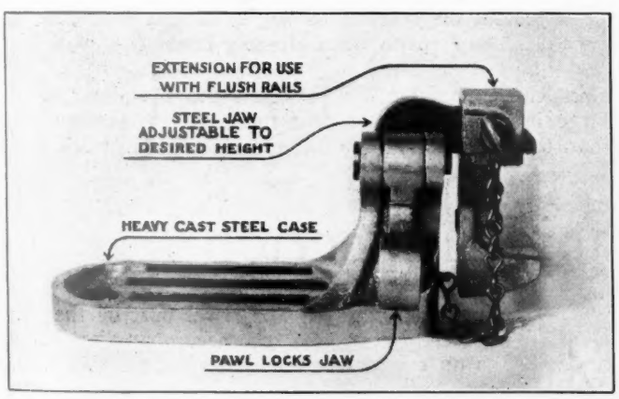


Fig. 1—Wheel dog with extension jaw in place ready for use when the rail is flush with the roadbed

and then forcing the wheel back down on the rail by means of a piece of timber used as a pry. This method requires an excessive amount of time and labor.

The device shown in the illustration provides a means of effectively holding the wheel to the rail without the necessity of using any blocking whatever. It consists of a heavy steel base and upright to which is attached a drop forged steel jaw adjustable to any desired height and a pawl which locks the jaws in place after the load has been applied. An extension, which is used when the rail is flush with the roadbed is attached to the base by means of a small light chain so that it will not be lost.

Fig. 1 shows the device assembled to be used when the rail is flush with the surface of the roadbed. The end of the extension rests on the flange of the wheel. When the weight is removed from the brass by means of a jack which rests on the base of the wheel dog, the pressure exerted by the jack on the device prevents the wheel from leaving the rail. Thus, in a comparatively short time the weight is removed from the brass to permit its renewal without the necessity of securing blocking to keep the wheel to the rail.

Fig. 2 shows how the device is used when the rail is above the surface of the roadbed. The adjustable steel jaw grips the flange of the wheel and when the load is

Fig. 2—Journal box jacked up off of the axle—The adjustable jaw has kept the wheel on the rail

applied to the base of the device the wheel is firmly held to the rail.

This device can be used to advantage by car and locomotive tender repairmen and by train crews. It is manufactured by the Railroad Wheel Dog Company, Provident Building, Tacoma, Wash.

Safety switch which protects operator and motor

A SAFETY switch known as the WK-55 has been introduced by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., the design of which provides full safety for the operator and the motor under all conditions.

In order to eliminate the possibility of the operator coming in contact with live parts when changing fuses, the switch has been designed with a double door construction. Within the main door of the switch is a smaller door giving access to the fuse compartment. This fuse compartment door is interlocked with the operating handle in such a way that it will not open until the switch is thrown to the off position. In this position, even with the door open no live parts are accessible and as long as the door remains open the switch cannot be thrown on. The outer door covering the entire switch enclosure is designed for padlocking so that it can be opened only by an authorized person. This door can be opened for inspection and testing without interrupting the service.

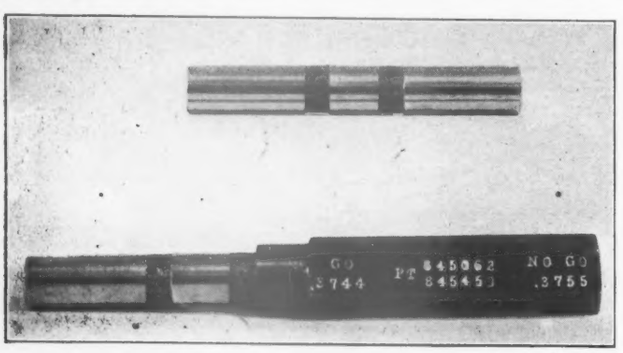
The design of a new "make and break" mechanism, entirely contained in the operating handle outside of the cabinet, does away with the possibility of failure of the switch box to function properly, which would produce dangerous short circuit hazards. This design removes the danger of loose parts coming in contact with current carrying parts of the switch and leaves more space for wiring.

An arc quencher of simple design has been developed that serves to extinguish the arc quickly and efficiently when the circuit is opened. It consists of metal laminations, separated by layers of insulation and air space. As the blade traverses the quencher, the arc is broken into a series of sparks that are cooled by the metal plates and by the air currents between them. As the blade passes through the quencher, the arc is dissipated and cooled to such an extent that the current drops to zero and the circuit is interrupted without danger or damage. The arc quencher is capable of breaking circuits carrying from 50 per cent more current in the larger sizes to 300 per cent more in the smaller sizes, than the rated amperes of the switch, even at 500 volts.

Westinghouse safety switch provided with a double door to prevent the operator coming in contact with live parts when cleaning fuses

Plug gage for rapid inspection

THE present day tendencies among the railroads is to work to closer limits. This requires more careful inspection and the use of various types of gages. The plug gage is being used to advantage to keep the work within the allowable tolerance. A new type of plug gage has been placed on the market by the Van Keuren Company, Watertown, Mass., which is designed to permit of rapid inspection.



Plug gage designed to give maximum service

The gaging unit, which is the novel part of the gage, is shown in the upper part of the accompanying illustration. It has on each end a "go" gaging member of the desired length, usually about 1 in., and in the center is a "no go" gaging member about ⅜ in. long. As the "go" member is the one which enters the hole and is subject to the most wear, this gage provides a maximum of wearing surface.

The plug gage unit is set in a handle as shown, being firmly cemented with stick shellac. The shellac protects the "go" member in the handle from corrosion, while the other end of the gage is being used. When one end is worn undersize, the gaging unit is reversed and thus a double life is secured. Sizes larger than ½ in. diameter may be used without a handle.

The gaging unit is made of a high grade tool steel selected for its wearing qualities and permanency. The steel is carefully hardened, thoroughly seasoned and the surfaces are lapped to a high finish.

These gages can be furnished to an accuracy of .00004 in., this accuracy being secured by light-wave measurement. Most plug gages have a wear allowance of about .0002 in. and the advantage of an accurate plug gage for tolerance work is that the gages may be kept close to the high limit.

A new tool for car repair work

MANY portable electric cranes of the battery driven, four-wheel steering type built by The Elwell-Parker Electric Company, Cleveland, O., are used in locomotive repair shops, stores departments and engine houses. To satisfy a demand to extend the work of these units beyond the planked platforms and concrete runways, a new type is now offered the car repair department. This unit, running on standard gage track, will pick up deliveries at the shop or in the yard and deliver them alongside or actually place the piece on the car ready for bolting or riveting. It is serving as a dismantler of cars as well as an assembler and gathers scrap or waste material which it places on the pile or in the scrap car.

Portable electric track crane handling corrugated steel car ends

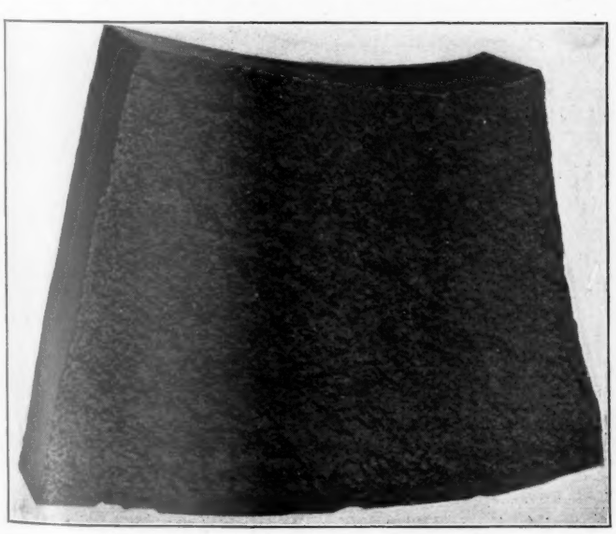
The crane consists of standardized units used on the floor type crane. Special heavy steel axles with good clearances beneath, fitting the standard gage rail track, are employed. The wheel base of the cranes is practically the same as most hand pushed cars and they use the same turntables as the latter.

The crane boom is of the telescopic type and of such length as to reach over the middle of a car on the adjacent track. The upper end of the boom is so curved that it clears the side of a gondola car 11 ft. above the rail. The operator retains his driving position on the tructor pedals when hoisting, raising or lowering the boom or when slewing it through 180 deg. from the right to the left track. All operations are by electric motor but the slewing may be effected by either hand or motor mechanism as specified.

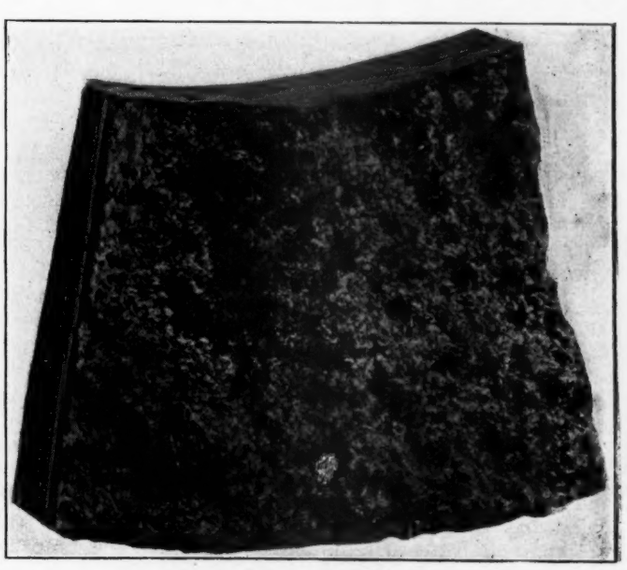
The outfit weighs approximately 7,000 lb. when fully equipped. It handles any load up to 3,000 lb. which brings within its range 90 per cent of the parts handled in car repair work. A crane on each third track serving cars on either side can do practically all the lifting and material handling, thus saving the use of the heavy locomotive type crane for work better suited to its capacity. The standard Elwell-Parker safety controls of power and brake are used throughout on this equipment.

Locomotive bronze crown bearings

WHEN bronze crown bearings are cast in sand molds more or less trouble is experienced with sand in the surfaces which makes them difficult to machine, and with sand or blow holes in the body of the casting which cause many brasses to be thrown away before they have worn down to the wear limit. In an effort to overcome this difficulty, the More-Jones Brass & Metal Company, St. Louis, Mo., has adopted the practice of casting crown brasses in metal molds.



Specimen of crown brass cast in a metal mold



Specimen of crown brass cast in a sand mold

This method is not entirely new but improvements have been developed by this company for which it has obtained patents.

An exhaustive comparative test has been made of bronze bearings cast in a chill and sand mold, the metal used being poured from the same pot. The results of these tests are shown below:

Chemical analysis

	Sand mold, per cent	Chill mold, per cent
Copper	72.70	72.55
Tin	7.10	7.15
Lead	18.80	18.95
Zinc and impurities	1.20	1.20
Phosphorus	.05	.05
Undetermined	.10	.10
	100.00	100.00
Brinnel hardness number	51	62
Tensile strength, 2 in. standard test bar	20,500 lb. per sq. in.	29,500 lb. per sq. in.
Elongation in 2 in., per cent	9.0	15.5
Elastic limit in compression (load necessary to produce a permanent deflection of .001 when applied to a 1-in. cube	11,800 lb. sq. in.	15.500 lb. sq. in.
Permanent deflection under load of 65,000 lb. per sq. in. when applied to a 1-in. cube	.28 in.	.16 in.

Transverse bending tests

Specimens 1 in. cross section; distance between supports, 10 in.; load applied at center.

Load, lb.	Vertical deflection, in. Sand mold	Chill mold
500	.013	.009
1,000	.035	.026
1,600	.063	.047
2,300	.340	.140
2,400	Specimen failed	.175
2,750		.300
3,200		.405
3,600		.520*

*Specimen started to fail.

The tests show that the pressure chilled cast bearings possess approximately a 50 per cent increase in the physical properties over the sand cast bearings. Furthermore, the chilled mold casting weighs five per cent more per cubic inch because of its density. The increased load factor and strength, due to the density of the pressure chilled cast bearing, are not the only real improvements; the pressure chilled cast bearings are free from sand, grit, oxidization and impurities.

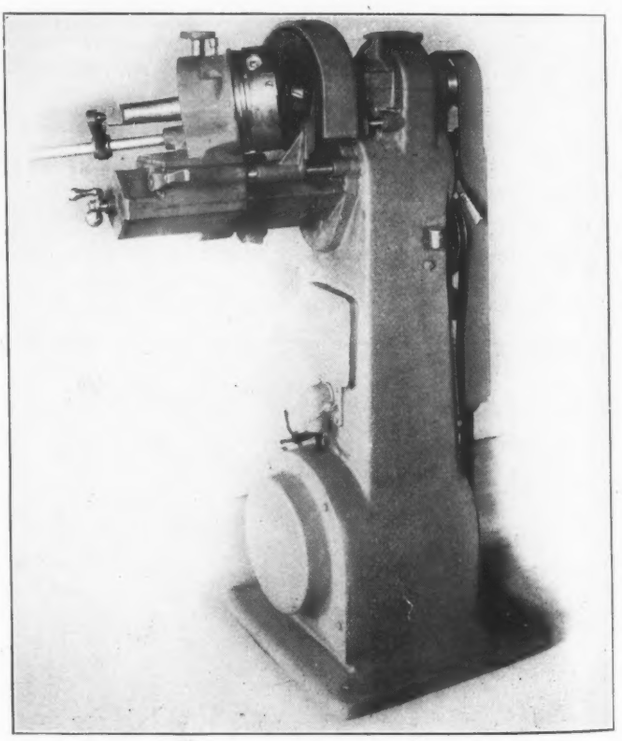
Oliver automatic drill pointer

THE efficiency of twist drills is largely dependent on proper grinding. If the clearance of a drill is insufficient or imperfect, it will not cut. When force is applied, it resists the power of the drilling machine and is crushed or split. It requires considerable skill on the part of a machinist to grind a drill so that the cutting edges have a proper and uniform angle with the longitudinal axis of the drill, having them of exactly equal length and the lips of the drill sufficiently backed off or cleared. In order to overcome this difficulty, the Oliver Instrument Company, Adrian, Mich., has had on the market for a number of years an automatic drill pointer designed to provide accuracy for this kind of work. The motions of grinding a drill are entirely automatic and are produced by fixed mechanisms. The drill is held in the machine in the same manner that it is held in a drill press. It is rotated automatically, stopping momentarily as each cutting lip is presented to the grinding wheel. The grinding wheel has two motions, one an oscillating motion which carries the wheel across the cutting edge of the drill; the other motion advancing the grinding wheel toward the drill as the drill revolves, the combined motions being such that a clearance is formed, the angle of which increases toward the center as is necessary for proper drilling. The operation of the machine depends in no way on the experience or skill of the operator. There are no adjustments on the machine and every type and size of drill is set exactly the same.

An improved design of this machine has recently been brought out. The grinding wheel on the old machine was carried in a rocker arm which oscillated across the point of the drill. It also had an end or axial motion which advanced the grinding wheel toward the drill as the drill revolved, producing the proper increase in clearance as the center of the chisel point of the drill was reached. Referring to the illustration, the new construction eliminates the rocker arm and the oscillating motion is obtained by the revolving of the wheel spindle in a quill, which has an eccentric motion. A cam operates the forward and backward motion of the quill, the same as in the old machine, but the new design has eliminated the universal shaft and joint.

Grinding is secured with a continuous fixed automatic multiple motion, producing a clearance, the angle of which increases toward the center as is necessary for proper drilling. The grinding wheel is thus given two motions in a manner similar to that described for the old machine. Both lips are ground with the same angle which insures the web being central, thus enabling bent drills to be ground accurately. Any practical combination of clearance angle, chisel point angle and drill point angle can be secured.

The chuck head is one of the new features which



An automatic drill pointer designed to produce a theoretically correct point

permits the holding of drills at the point instead of at the shank. The drill holding chuck can be perfectly centered or set for grinding off center as desired. This construction does not permit the changing of the point angle. Where this is desired, the manufacturers supply a chuck equipped with a universal head which holds

drills by the shank in a manner similar to the old machine. The new construction gives a continuous motion to the drill which increases the grinding speed about 50 per cent over that of the old type. The clearance cam being concentric with the wheel spindle eliminates possibility of lost motion between the cam and the drill.

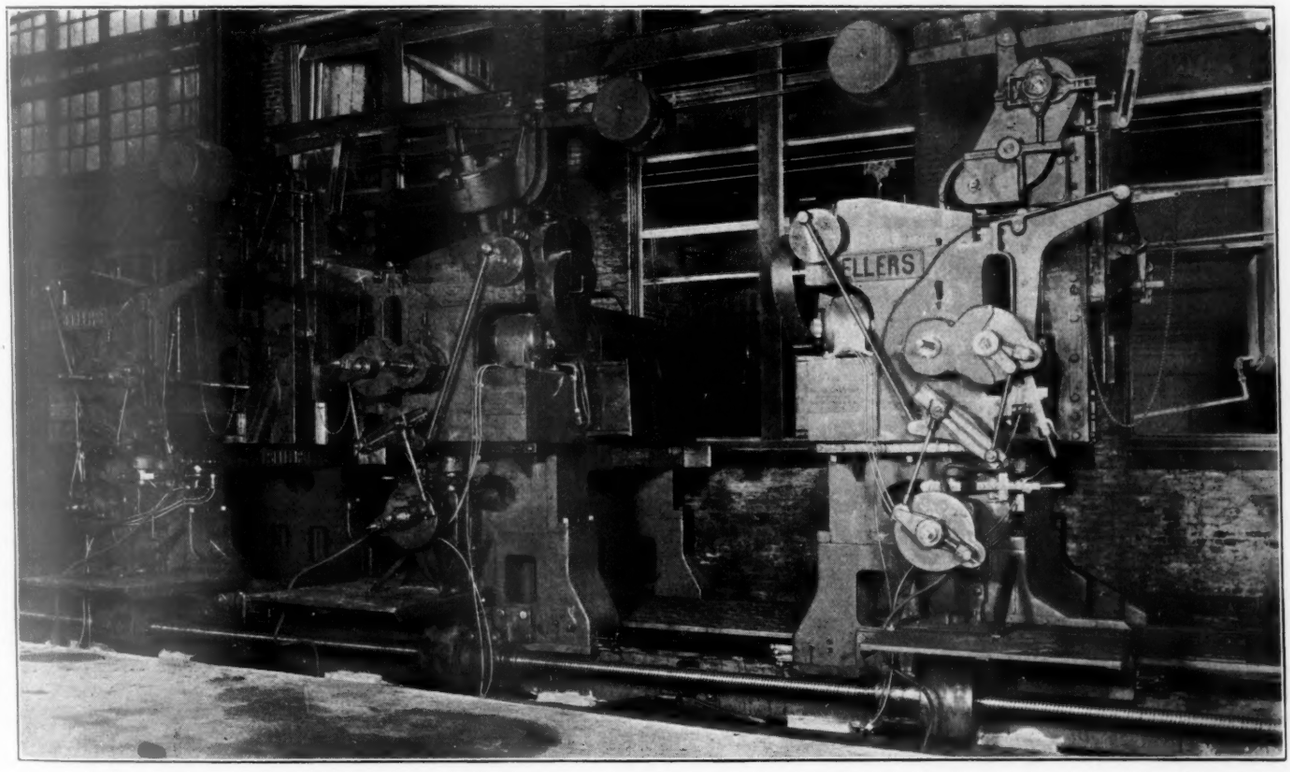
A feature of the new machine is the elimination of the need of cooling water. There are two reasons for this. First, the direction of grinding tends to carry the heat away from the cutting edge of the drill. Second, the grinding of the drill while it is revolving presents each lip to the wheel momentarily, thus giving the heat a chance to be carried away from the edge while the next edge is coming in contact with the wheel. This permits the feeding of the drill as rapidly as the strength of the wheel will permit. It is claimed that with the addition of water, the speed of grinding could not be materially increased.

The Oliver automatic drill pointer is supplied in various sizes, one of which has a capacity up to 1½ in.; one a capacity up to 3 in., and a small type machine, a capacity from the smallest up to ½ in. and for two flute drills only. The larger machines are adjustable for either two, three or four flute drills.

Triple head locomotive frame slotter

A FRAME slotter has been designed and built by Wm. Sellers & Company, Inc., Philadelphia, Pa., to meet the requirements of constantly increasing sizes of locomotive side frames. While the machine is based on the best features of the smaller size Sellers frame slotters, it incorporates the advantages of the Sellers spiral pinion planer drive and improved reversing planer motor and control apparatus.

The machine consists of a heavy bed furnished with convenient bolt slots and supporting three slotting heads. The latter are moved by means of revolving nuts and a single screw extending along one side of the bed. They are guided by one upright with a relatively long bearing on the bed. The screw is stationary and therefore always kept in tension. As the bed is over 60 ft. long, the screw is provided with tumbler bearings which automatically move out of the way as the head approaches.



The Sellers triple head frame slotter

Each head consists of a substantial crossrail supported on two uprights or legs. The face of this crossrail is 3 ft. 10 in. from top to bottom and the depth of the rail is 3 ft. 5½ in. at the lower end and 2 ft. 5½ in. at the top. The uprights or legs of the cross head each have a bearing on the bed of 6 ft. 6 in. in length. The width of the main upright, which is used for guiding, is 16 in. and the width of the other is 10 in. The uprights are 5 ft. apart, giving ample dimensions on each side of the largest frame made. The height under the cross rail is 42 in. which is sufficient to allow four 9-in. frames to be slotted at one setting. The cross rail may be swivelled by a ratchet to 6 deg. on each side, allowing for the angular surfaces of the frames.

A saddle or slotting head of new design is mounted on each cross rail and provided with 5 ft. 3 in. of travel by means of a screw along the rail. Adjustable taper gibs are provided to take up the wear between the saddle and the rail.

Probably the most noteworthy feature of the slotting head is the method of driving the slotting bar. The

Sellers spiral pinion planer drive is used for this purpose. The driving shaft is actuated from the reversing motor through only two pairs of gears, one of which has herringbone teeth. Variations in the speed of the slotting bar are easily obtained by varying the motor speed with field rheostats. Cutting speeds of 25 to 50 ft. per min. are provided and return speeds of 50 to 75 ft. per minute. Speeds faster than these could be easily obtained, but are not found to be profitable when used with short strokes.

It is interesting to note that one difference between a crank driven slotter and a reversing motor driven slotter is that on the former the cutting speed varies from zero at each end to a maximum speed at the middle of each stroke, while the reversing motor driven slotter keeps the cutting speed constant throughout the stroke except for the acceleration at the start, and deceleration at the end.

The ram is made of steel and is of box section 8 in. by 15 in. outside dimensions. It is 6 ft. long so that there is always sufficient bearing in the guide to take the pressure of the cut and prevent deflection at either end of the stroke. A shoe, adjustable by set screws, is provided at the side of the ram to take up wear, and to help maintain alinement. The ram is counterweighted and provided with a forged steel rack 5 in. wide. The guide for the ram is 7 ft. 6 in. long.

Each head is provided with an electric feed mechanism. It gives the advantages of simplicity, easy adjustment and accurate timing. It is set to take the minimum amount of stroke to perform the feed. Feeds of 1/64 in. to ¼ in. are provided in small increments. At the end of each stroke the feed motor, which is connected to the feed discs, is started and runs until it has driven the discs 180 deg. when it stops. The starting and stopping of the feed motor is arranged through the master switch reversed by the ram, by means of a special limit switch. The feed motor is started at each end of the stroke of the ram and as it only requires a few seconds to move the disc, it is arranged to start just before the end of the stroke, and thus divide the time of operation between the two strokes. This reduces to a minimum the amount of stroke required for feed. Moving the feed discs operates the crank and ratchet from which both motions are set for the proper amount of feed.

The traverse of the saddles on the crossrail and of the crossrail on the bed are obtained with the same motor that is used for the feed. The push button control enables an operator to set his tool so closely that it is not necessary to use the hand adjustment. The latter is provided, however, in case it is desired. The speed of travel of the saddle and crossrail is 4½ ft. per minute.

The machine is equipped with several safety devices. The ram is provided with a mechanical knockout at each end of the stroke which disconnects the driving gear from the ram and instantly applies a brake. This protection is not necessary but is desirable in case the operator fails to set the stops properly or in case the stops become loose. There are limit switches at either end of the travel of the saddle on the cross rail which prevent traversing or feeding too far in either direction. The feed and traverse are interlocked so that the traverse cannot be started with the feed clutch engaged and vice versa. Furthermore, the tool ram cannot be operated while traversing, as it is considered dangerous to have the two operating at the same time.

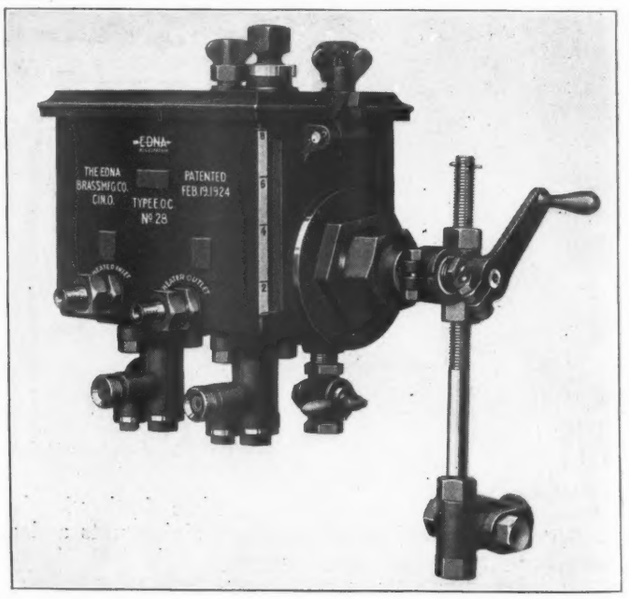
Locomotive force feed lubricator

A FORCED feed lubricator designed to meet railroad requirements has been placed on the market by the Edna Brass Manufacturing Company, Cincinnati, Ohio. It is made in five different sizes of two, three, four, five and six feeds with oil capacities of 8, 9, 10, 11 and 12 pints, respectively.

The body is equipped with sight glasses, one in each end, and a gage rod through the cover. Pint marks are stamped on the body. The lid is hinged. The lubricator can be used either right or left hand and to make the change requires only the reversing of the drive shaft and the lid. The drive is a fifty-tooth hardened steel ratchet and three pawls. The reverse ratchet is steel and is operated both by power from the locomotive and by hand. The forcing units consist of a hollow plunger and cylinder of steel, with brass and other metals suitable for their performance. The parts are immersed in oil at all times and require no attention. The discharge is made through the unit holder, equipped with two steel ball checks. The line check seat is steel hardened and ground. A second or intermediate ball check is used as added precaution against water leaking back to the lubricator.

In installing the lubricator, a suitable bracket ¾ in. thick should be provided with a length equal to that of the lubricator body and secured to a rigid part of the locomotive, preferably to studs in the back valve chamber head. Should conditions prevent, it can be placed elsewhere, but if it is not absolutely rigid, broken pipes may result. The terminal valves are provided with ½-in. standard pipe threads; these should be attached to tallow studs and can be set in any position.

The bodies of all the lubricators are equipped with heaters for a ⅜-in. steam pipe connection in which either live or exhaust steam can be used. If exhaust steam is used, it should be taken from the air pump exhaust. Precaution in piping must be taken to avoid water traps in

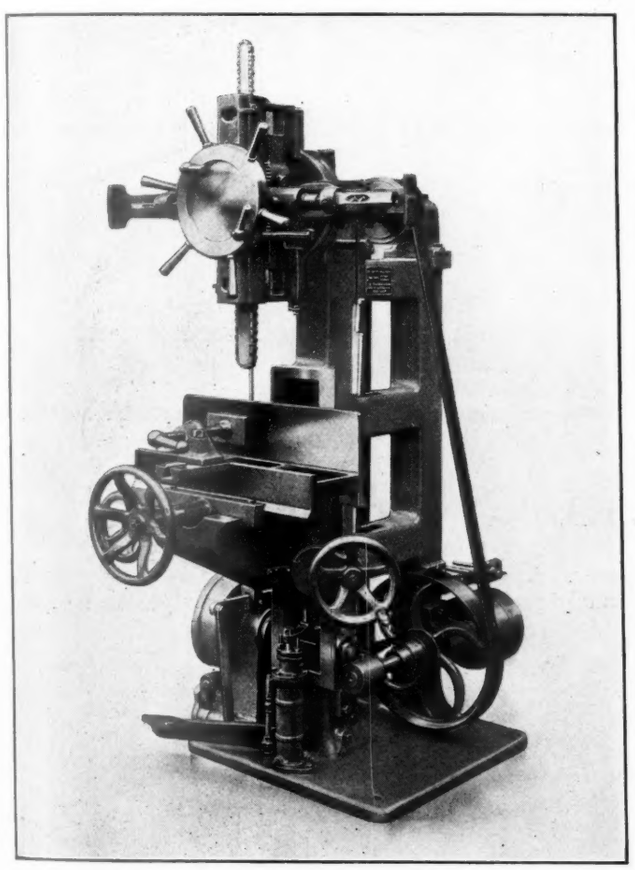


Force feed lubricator designed to prevent water from leaking back to the lubricator

order to prevent freezing in cold weather. The terminal valves are set at 225 lb. pressure at the factory. This is sufficient in all cases where boiler pressure is lower than 210 lb; if a higher boiler pressure is carried, it will require the resetting of terminal valves to about 15 lb. higher than the boiler pressure.

Automatic chain and hollow chisel mortiser

IN the past the chain and chisel mortisers manufactured by B. Smith & Son, Bingley, England, have been operated by hand levers. The drawback with these machines was principally with the chisel slide which could not produce a mortise hole larger than 5/8 in. square and to do this required a great amount of energy because it was necessary to broach a square hole as the boring augur did not bore a square hole. It had to be squared by the exertions of the operator. To overcome this undesirable feature, a full automatic chain and hollow chisel mortiser has been designed by the above manufacturer of machines of this type.



A square hole can be bored without any effort on the part of the operator

The body of the machine is in one piece and is of the open-column type which exposes every working part to the operator. The table has three positive ranges or travel to suit different size mortise holes. In the event of a chain breaking, there is a slipping clutch incorporated in the feed shaft mechanism which prevents any damage being done to either the tools or the machine. The table is fed up to the work by a rack and pinion. Mounted on the end of the pinion shaft is a large bronze work wheel and mounted directly underneath this wheel is a hardened worm running on the second gear shaft. This shaft is pivoted at its extreme end and on the operator pressing down the feed pedal this worm and shaft are raised into engagement with the large worm wheel and the table immediately begins to rise. On completion of the mortise, the operator simply releases the pedal which disengages the feed and the table descends rapidly but without shock or jar. The cushioning of the table on its return stroke is obtained through the action of a piston working inside a hydraulic cylinder.

A hand wheel is mounted on the right hand side of the saddle and by turning this wheel to the right the table is locked and held in any position after the foot has been removed from the feed treadle. This enables the slots to be cleaned out and when the table is required to descend, a quarter of a turn to the left of this hand wheel releases the table.

The drive is direct on to the main bottom shaft through the usual fast and loose pulleys and from this shaft a straight belt drives the top shaft upon which is mounted a friction clutch. This clutch is out of engagement when the table is at the bottom and in consequence the clutch spindle of the machine is stationary. When the operator presses down the foot pedal the table begins to ascend and a lever which is in engagement with the clutch and is held out of gear when the table at the bottom is then liberated, allowing the clutch spring to engage the loose portion of the clutch with the fixed, causing the clutch shaft to revolve. On completion of the mortise the table descends and on reaching the bottom, the clutch is automatically brought out of engagement, and the mortise chain cutter or hollow chisel comes to rest.

The turret mortise head is mounted upon a continuation of the top clutch shaft and carries four slides. There may be any combination of four different tools. As arranged, there is alternately a chisel slide and then a chain slide. Each of these slides carries either a complete attachment for driving a mortise chain or hollow chisel and they are mounted on ball bearings throughout. The end of the clutch shaft has mounted on it first, a straight spur wheel and then a bevel wheel. The spur wheel will engage with the chain slide and the bevel wheel with the hollow chisel slide. These slides are held out of engagement with a strong spring which is concealed within the slide, but upon the operator pulling the handle, which is mounted at the right of the machine, towards him, the turret is disengaged and can be revolved round in either direction. As each slide passes the bottom center, which is the working position, a fixed cam at the back of the turret engages with a roller fixed upon a stud and carried by each slide, causing the slide to be raised into gear with the wheel mounted upon the clutch slide, at the same time the turret automatically locks itself in this position and the cutting tool, whether chain or chisel, is in the correct cutting position. It will be clear from the above that only one tool is in engagement at one time and only this one is in rotation when the table is in motion. The turret can be swung round and any cutter brought into engagement without any risk to either the operator or the gears, because these are all stationary when the tools are being changed.

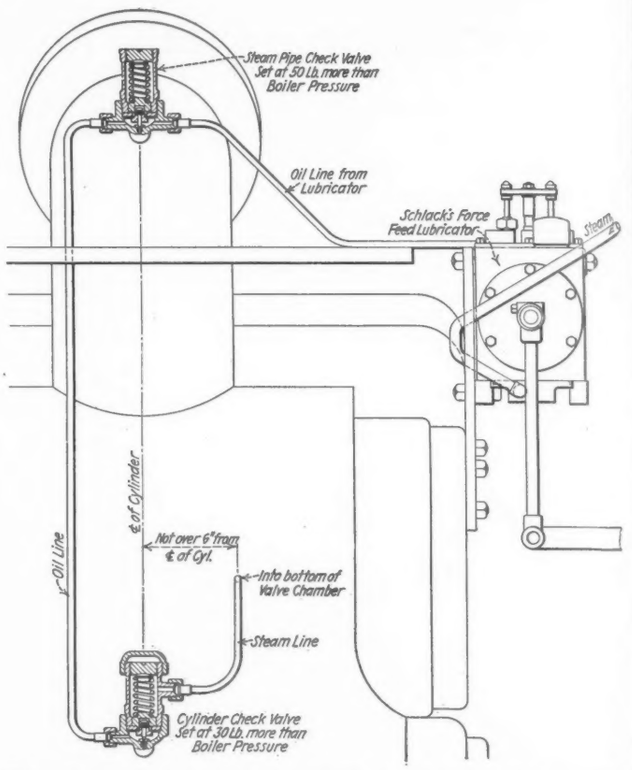
Schlack's force feed lubricator

WITH the system of alternate valve and cylinder lubrication for locomotives shown in the illustration, all of the oil is delivered into the steam pipe when the locomotive is working steam, but when the locomotive is drifting, all of the oil is delivered directly into the cylinders. In the alternate system there is a check valve in each cylinder in addition to a check valve in each steam pipe for each feed. The steam pipe check valve is set with a spring pressure to release at 300 lb. per sq. in. and has one oil inlet and two oil outlets. The cylinder check valve is set with a spring pressure to release at 250 lb. per sq. in. and has one oil inlet and one oil outlet and in addition has one steam inlet.

An oil pipe conveys the oil from the lubricator to the steam pipe check valve. Another oil pipe conveys the oil from the steam pipe check valve to the cylinder check valve. A steam pipe conveys the pressure from the pressure chamber of the main valve of the locomotive to the chamber on top of the diaphragm of the cylinder check valve.

When the locomotive is working steam, the steam pressure added to the spring pressure of 250 lb., the cylinder check valve holds the cylinder check valve spring to a higher oil pressure release than the steam pipe check valve with a spring pressure of 300 lb. The result is that all of the oil is injected into the steam pipe while the engine is working steam.

When the engine is drifting, the cylinder check valve is relieved of the steam pressure when the locomotive throttle is closed, so that it opens at the spring release pressure of 250 lb. This pressure being less than the spring release pressure of 300 lb. of the steam pipe check valve, all of the oil is injected directly into the cylinder. This lubricating system has been placed on the market by the United States Metallic Packing Company, Philadelphia, Pa.


Steam Pipe Check Valve Set at 50 Lb. more than Boiler Pressure
Oil Line from Lubricator
Schlack's Force Feed Lubricator
Steam
℄ of Cylinder
Not over 6" from ℄ of Cyl.
Oil Line
Into bottom of Valve Chamber
Steam Line
Cylinder Check Valve Set at 30 Lb. more than Boiler Pressure

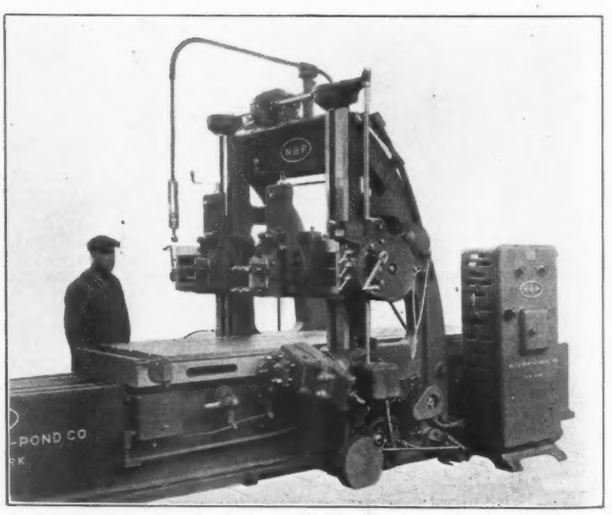
Piping arrangement for alternate valve and cylinder lubricator

Effective safety features for planers

AN operator when setting up work on a planer often has part or all of his body between the work and the planer, and thus is in danger of injury by unintentional starting of the machine. Many planers afford absolutely no protection from this danger. A man may stumble against one of the control levers on either side of the bed, a passing truck may strike it, or it may be hooked by a swinging crane chain. A helper working around the machine and removing chips may move one of the control levers at any time, starting the planer suddenly and without warning.

It is possible to lock the control levers in the off position, but such locks are a source of danger, as they may become engaged while the planer is running. In this case some part of the reversing mechanism must break and the planer usually fails to reverse, running the table off the driving gear. Furthermore, it is well known that safety devices which require extra movements on the part of the operator are practically never used.

The master pendent switch, shown in the illustration, is designed to prevent such accidents. This is an important part of the electrical equipment furnished by the Niles-Bement-Pond Company, New York, on planers driven by direct connected reversing motors. A distinctive feature of this switch is that it may be used for instantly stopping the machine by pushing the handle upward. Operators make a practice of using it for this purpose because it can be reached more easily and quickly than the control lever. The planer cannot be started except by deliberately pulling down the handle of the pendent. Accidental starting is impossible and the operator is perfectly safe, no matter what happens to the control lever.



Location of the pendant switch in relation to the position of the operator

This switch may be used at any time without first throwing a distant transfer switch. Neither does the operator need to leave his position when resuming normal operation. The entire control of the table motion, starting, stopping, reversing or "jogging" by very small fractions of an inch is obtained by this switch. It is this feature which makes the master pendent so convenient and valuable as a safety device. The switch hangs by a flexible cable from a swivel on the arch or crosstie of the planer, permitting the operator to keep it in a location convenient to his working position. This makes it possible to stop the planer instantly in an emergecy, as the operator does not have to stoop and reach for the control lever, but simply hits the handle of the pendent.

When starting a cut, the operator should take the pendent in one hand and the feed crank in the other. He can then feed in with confidence, as he can stop the machine instantly if the tool approaches a high spot on the work. Any lumps on the casting may be removed by a few short strokes, and considerable time is saved in starting the cut.

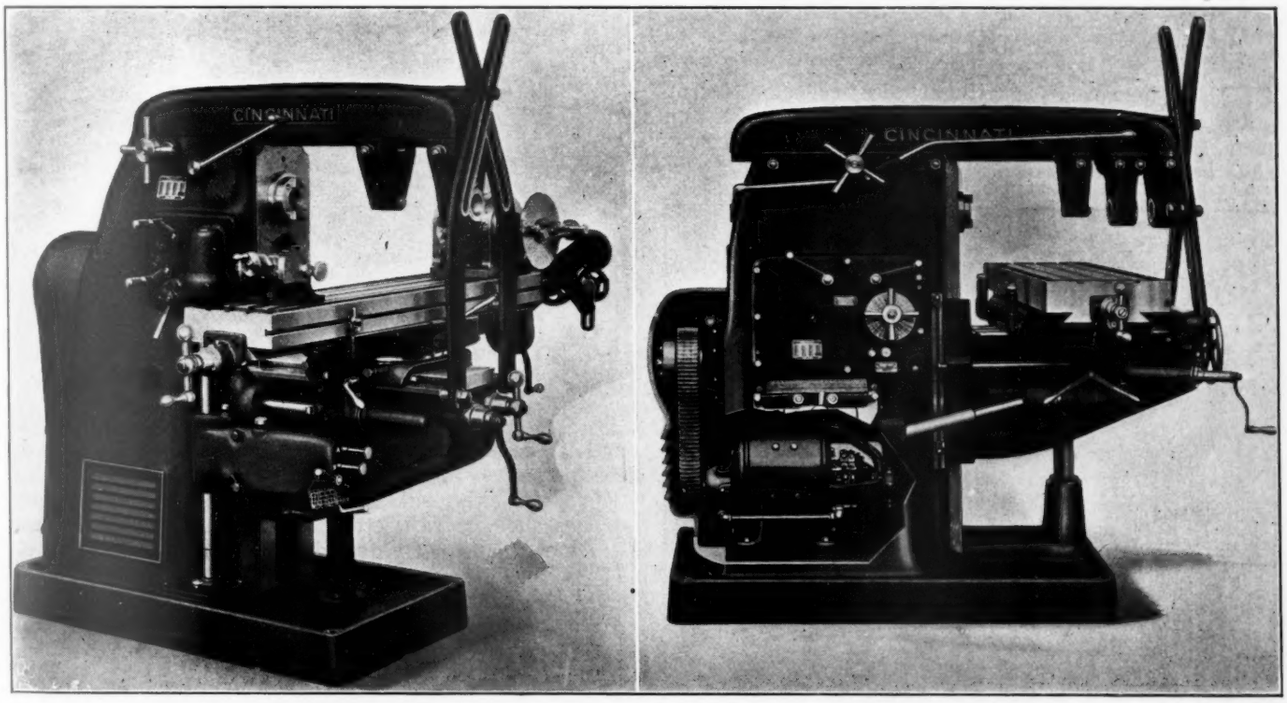
Another possible source of accident is failure of voltage. This occurs at timcs in every plant due to powerhouse trouble, blowing of fuses or opening of circuit breakers. As a result, the planer motor is left without a field and unless some means of stopping is provided, the planer will overtravel. Overtravel of a planer table is apt to cause serious damage, both to the work and to the machine, and is dangerous for the operator. Overtravel of planers having Niles-Bement-Pond controllers is prevented by the patented emergency brake winding and circuit breaker. If the voltage falls below a safe minimum, the breaker opens instantly and applies a powerful dynamic brake, stopping the planer at once. The special brake winding takes power from the armature when the breaker opens and is effective regardless of the reduction in line voltage. The circuit breaker prevents the planer from starting on return of the voltage, and also gives complete overload protection.

The crossrail elevating motor is also interlocked with the main driving motor, so that it can be run only when the planer is stopped. It may be controlled from either side of the bed or from the pendent switch, assuring the operator a good view of the work.

Milling machines adaptable for railroad shops

THE milling machines shown in the illustrations have recently been placed on the market by the Cincinnati Milling Machine Co., Cincinnati, Ohio. Both of these machines contain new features of design heretofore not a part of the older types of machines.

The column is interchangeable for overhead belt or enclosed motor drive. The motor is bolted to a flat plate machined on both sides, which in turn is securely fastened to the box section base of the machine by heavy bolts. The drive from the motor to the shaft is by means



The left view shows the pyramid column M Type Universal milling machine—At the right is the No. 2 and No. 3 high power pyramid column milling machine with the column broken away showing the location of the motor

The most prominent change in design is the pyramid form column which tapers gradually in a straight line from the overarms to the rim of the base. The purpose of this design is to provide maximum strength and rigidity to the column, a proper foundation for heavy cutting and a space for an enclosed motor drive.

of a silent chain. Ample ventilation is secured through vents in the sides of the column and the rear cover of the motor compartment. Provision is made for easily and quickly oiling the motor and adjusting the brushes through the vent holes.

The speed mechanism of these machines are provided

with tapered roller bearings, which are new with these machines. Besides the two features already mentioned, the following are also common to both types of machines. Automatic oiling in the column; centralized oiling for the knee, saddle and table; power rapid traverse; sliding gear transmission; multiple disc clutch running in oil; double starting levers, and rectangular overarms.

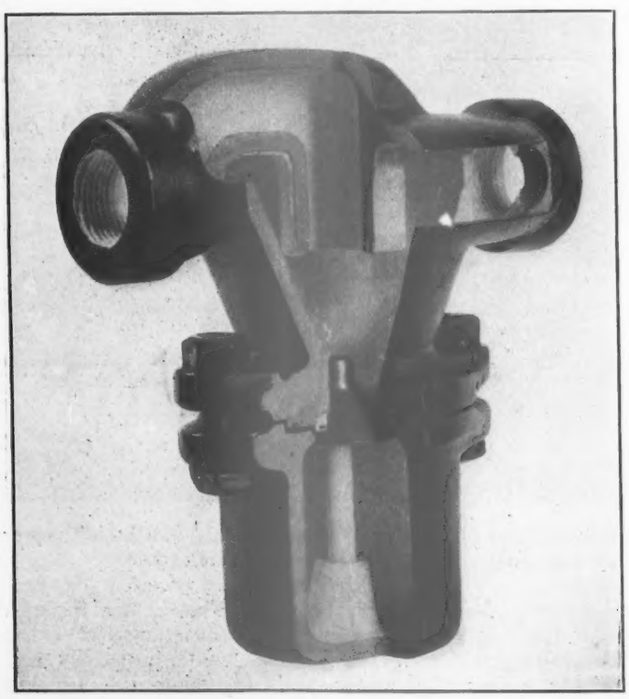
Careful consideration has been given in the arrangement of the levers so that the operator can control the machine from one position, thus eliminating any unnecessary movements about the machine. Double control levers have been provided so that the machines can be operated from either side.

The type M machine contains several refinements in design. A properly designed tapered gib connection to the column eliminates the necessity for clamping the knee, even when taking the heaviest cuts. A single piece vertical screw instead of the usual telescopic screw construction is employed. This arrangement lends itself in obtaining accurate and reliable dial readings. The saddle bearings for the table are as long as the full table travel. The wide knee bearing reduces the tipping tendency to a minimum.

There are certain fundamental differences between the M-type machine and the No. 2 and No. 3 machines. On the M-type machines the feed box is at the front of the knee, whereas on the No. 2 and No. 3 machines it is located at the side of the column. The power quick traverse is not supplied on the former type, whereas it is supplied on the latter.

Westinghouse centrifugal dirt collector

THE improved centrifugal dire collector recently developed by the Westinghouse Air Brake Company, Wilmerding, Pa., will contribute to economy and better maintenance of brake equipment. This is due to the generous size of the chamber in which the dirt is deposited, its large capacity making it possible to accommodate all the dirt entering between cleaning periods. Moreover, cleaning is easily accomplished, it being necessary to remove but two bolts and drop the reservoir.



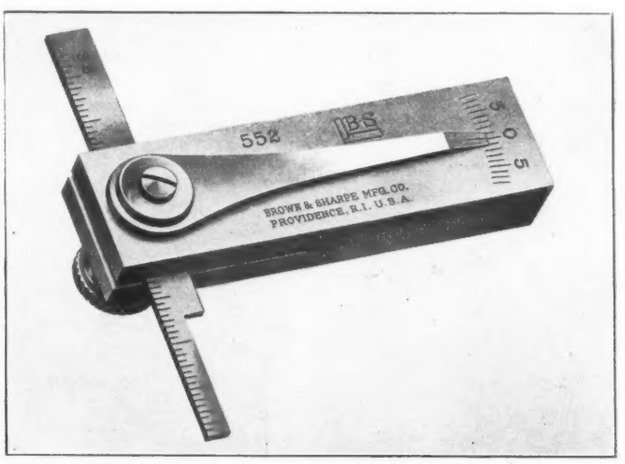
Centrifugal dirt collector containing a large dirt chamber and valve to prevent blow-back

Another feature of the design is that obtained by the brass umbrella-shaped valve which floats on a stem in the lower chamber. Consequently, during charging of the equipment the swirling air currents impart a rocking motion to the valve which in turn deflects dirt particles into the chamber. The rapid reduction of the air pressure above the valve causes it to lift and seal on the seat, thereby isolating the dirt chamber so that no dirt can re-enter the brake system after once being collected. It is supplied both with and without drain cocks.

A diemaker's square

THE gage shown in the illustration is a handy tool for establishing clearances of drop forging dies and die castings. The pattern maker can also check drafts of patterns with it. This versatile gage is sold by the Brown & Sharpe Manufacturing Company, Providence, R. I.

It is easily set at any angle within its capacity by simply moving the pointer to the correct graduation mark and tightening the knurled nut. The blade moves with the pointer. The graduations on the body read eight degrees on either side of the zero mark. Thus, the angle of clearance or draft setting is obtained by direct reading. A protractor is not required for setting this tool.



Brown & Sharpe diemaker's square

The blade is carefully graduated for 1 in. from either end—one side in 1/32 in., the other, in 1/64 in. The narrow end of the blade is 7/64 in. wide for small holes and the other end is 7/32 in. wide. The body is hardened and ground.

THE LAW OF NEW YORK requiring all locomotives to have side vestibule cabs, which has been before the courts for years, because of the refusal of the Public Service Commission to enforce it, has finally ben enullified by the Court of Appeals, which recently handed down a decision sustaining the commission in its ruling. The commission held that as the federal law covered the whole field of locomotive inspection, the state had no power to act. The firemen's brotherhood challenged the judgment of the commission and entered the suit to compel it to recognize the statute.

General News

The employees of the Paris (Ky.) shops of the Louisville & Nashville on July 31 completed a full year of work without a reportable injury to any employee.

The shops of the Delaware, Lackawanna & Western have been ordered to work only four days a week, the amount of car repair work having fallen off because of the strike in the anthracite mines. About 2,500 men are affected.

The Interstate Commerce Commission has denied a petition of the Chicago, Milwaukee & St. Paul for a suspension until further order of the second automatic train control order, entered January 14, 1924; but has granted another petition for an extension of time from July 1 to January 1, 1926, for the fulfilment by this road of the requirements of the first order (June 13, 1922). The commission has also postponed the effective date of the first order for the Chicago & North Western from July 1 to January 1, 1926.

Shop construction on the Chesapeake & Ohio

A contract has been awarded to Milo R. Hanke, Cincinnati, O., for the erection of a new boiler shop for the Chesapeake & Ohio at Huntington, W. Va. The building will be of steel and brick construction with a cement tile roof and a wood block floor, 140 ft. by 404 ft. It will have a boiler shop bay 90 ft. wide with a clear height of 40 ft. 6 in. and a machine bay 50 ft. wide with 37 ft. clear height. Two 15-ton electric traveling cranes will be installed in the machine bay and a 50-ton one in the boiler bay. The building will also have a number of 2-ton and 5-ton jib cranes. Modern machine tool equipment will be provided. The total cost of the project is estimated at $575,000.

Pennsylvania gives extensive automatic train control order

The Pennsylvania Railroad has given to the Union Switch & Signal Company a contract for automatic train control, the Union continuous induction system providing for the installation of the system on over 1,000 miles of road. Locomotives to the number of 1,000 will be equipped. This proposed work, complying with the Interstate Commerce Commission's general policy, will cost from six to seven millions of dollars.

Cost of fuel

The cost of fuel for road locomotives in freight and passenger train service (charged to operating expenses) for Class I steam roads for the first six months of 1925 was $163,120,525, according to the monthly report published by the Interstate Commerce Commission, as compared with $185,572,620 in the corresponding period of 1924. The average cost of coal per ton was $2.78, as compared with $3.18 last year, but the average cost of fuel oil increased from 2.73 cents a gallon to 3.17 cents. For the month of June the average cost of coal was $2.70 and the average cost of oil was 3.28 cents, making the total cost of coal and fuel oil for the month $24,376,103, as compared with $25,314,756 last June. For the six months' period the number of net tons of coal consumed was only 47,406,574, as compared with 49,721,957 last year.

Locomotives inspected

During August 6,604 locomotives were inspected by the Bureau of Locomotive Inspection of the Interstate Commerce Commission, according to its monthly report to the President on the condition of railroad equipment. Of these 2,689, or 40 per cent were found defective and 275 were ordered out of service. During the same month 121,328 freight cars were inspected, of which 3.3 per cent were found defective, and 2,421 passenger cars, of which 27 were found defective. During the month 17 cases, involving 32 violations of the safety appliance acts, were transmitted to various United States attorneys for prosecution.

N. Y. C. runs passenger engine without change between Harmon, N. Y., and Chicago

On Sunday, September 13, New York Central engine No. 3334 completed its first round trip from Harmon, N. Y., to Chicago and return without change en route. The locomotive left Harmon, the terminal of the electrified division out of New York City, Thursday afternoon, September 10, at 6:30 p. m., eastern standard time, on the Lake Shore Limited, arriving at Chicago September 11 at 4:00 p. m., central standard time, after a continuous operation of 946 miles in 22½ hrs. After a layover of approximately 24 hrs., this locomotive started the return trip on the Lake Shore Limited at 5:30 p. m. Saturday, September 12, completing the trip at Harmon the next day at 4:22 p. m. This constitutes a record for the New York Central which, however, already has increased the length of the locomotive runs on its through passenger trains so that the present practice is to change engines at Buffalo only, where formerly seven locomotives were required to complete the run between Harmon and Chicago.

New freight cars placed in service

A total of 83,291 freight cars was placed in service during the first six months of 1925 by Class I railroads, according to a statement issued by the Car Service Division of the A. R. A. This was an increase of 12,417 cars as compared with the number installed in the corresponding period of last year and an increase of 4,051 cars as compared with 1923. The total included 43,627 box cars, 29,504 coal cars and 3,382 refrigerator cars. There was, however, a substantial reduction in the number of new freight cars on order on July 1, to 28,197, as compared with 60,315 last year and 96,855 in 1923.

Class I railroads during the first half of 1925 also placed in service 927 steam locomotives, compared with 1,071 during the same period last year and 1,998 during the same period in 1923. The same roads on July 1, 1925, had 279 locomotives on order compared with 360 on the same day last year and 1,902 two years ago.

The figures as to cars and locomotives include new, rebuilt and leased equipment.

The average capacity of the freight cars owned by the Class I railroads on July 1 this year was 44.56 tons, as compared with 43.88 tons on the same date last year, or an increase of 1.5 per cent. The average tractive power per locomotive on July 1 this year was 40,215 pounds, as compared with 39,571 pounds on the same date last year, or an increase of 1.6 per cent.

Anniversary and celebration of Pitcairn car shop

The tenth thousand car was recently turned out of the steel car shop of the Pennsylvania at Pitcairn, Pa., and this event was celebrated by an old-fashioned anniversary and celebration, consisting of athletic contests, musical entertainments, dancing and band concerts. The Pitcairn car shop, established in 1890, consisted of a roundhouse for repairing freight cars, a small brick office building and four repair tracks. The present roundhouse in which repairs are made to freight and passenger cars and locomotive tenders, contains 42 repair tracks. The steel freight car repair shop, erected in 1923 at a cost of approximately $1,000,000, is equipped with all modern and labor-saving devices. The main building of this shop is 100 ft. wide and 620 ft. long, and the rivet cutting building, 35 ft. wide and 200 ft. long. Approximately 800 men are employed in the steel car shop and a car is rebuilt and turned out every 24 min. Passenger cars are given heavy running repairs, and there is also a progressive system for class repairs to 22 passenger cars per month, this being the only class repair shop in the Central region. About 4,000 freight cars are repaired on various repair tracks per month. Repairs also are made to locomotive and car air brake parts for all points on the Western Pennsylvania division. There is a machine shop, forge

shop, paint shop, cabinet shop, upholstering shop, tin shop, blacksmith shop and a large stores department which furnishes material for the entire shop.

Progress in train control installation

The work of installing automatic train control devices in accordance with the orders of the Interstate Commerce Commission, which will require the expenditure of approximately $26,000,000 by the 45 roads named in Order No. 1, is progressing rapidly, according to a statement issued by W. J. Harahan, chairman of the Committee on Automatic Train Control of the American Railway Association.

Up to August 1 this year, out of 7,745 miles of track of the 45 carriers designated for installation of train control devices, installation had either been completed or was under way on divisions totaling 5,044 miles, or 65 per cent of the total mileage covered by the order. On January 1, last, installation had been completed or was under way only on 3,592 miles, or 42 per cent.

All of the 45 roads have selected a train control device for installation. Three roads have selected the ramp type, 23 the intermittent induction type, 13 the continuous induction type, and 6 the plain automatic stop using continuous control.

Thirteen roads have completed permanent installation, while 16 roads have permanent installation now under construction. Preliminary installations have been completed by 13 roads, while 3 others have preliminary installations now under construction.

The original order of the commission named 49 roads, but the Chicago, St. Paul, Minneapolis & Omaha; the Buffalo, Rochester & Pittsburgh; the Western Maryland, and the Chicago & Erie were later exempted. The commission on January 14, 1924, in its order, No. 2, also ordered 47 of the roads listed originally to install train control devices on a second division, but later exempted five of those roads. The commission in its Order 2 also ordered 45 additional roads to equip one division prior to February 1, 1926. Later, at the request of the carriers, the commission also suspended the second order so far as the 45 additional roads were concerned.

The permanent installations completed or in service, according to reports of the roads to the Interstate Commerce Commission, are as follows:

Road	Location	Maker	Mileage
Atchison, Topeka & Santa Fe	Chillicothe, Ill., to Shopton, Ia.	Union	209
Chesapeake & Ohio	Gordonsville to Staunton, Va.	American	61
Chicago & Eastern Illinois	Chicago to Danville, Ill.	Miller	210.8
Chicago, Rock Island & Pacific	Blue Island to Rock Island, Ill.	Regan	330
Galveston, Harrisburg & San Antonio	Rosenberg to Gidden, Tex.	National	50.6
Missouri Pacific	Leeds, Mo., to Osawatomie, Kan.	National	49.9
New York, New Haven & Hartford	Air Line Jct., to Springfield, Mass.	General and Union	124
Norfolk & Western	Hagerstown to Shenandoah, Va.	Union	105.8
Oregon-Washington R. R. & Navigation Co.	Portland to The Dalles, Ore.	Union	86.5
Reading	Camden to Atlantic City, N. J.	Union	108.2
Southern Pacific	Oakland to Tracy, Calif.	National	98.8
St. Louis-San Francisco	Nichols to Monett, Mo.	National	44.4
Union Pacific	Sidney, Neb., to Cheyenne, Wyo.	Union	204

Permanent installations are under construction on the Atchison, Topeka & Santa Fe (second Order); Atlantic Coast Line; Baltimore & Ohio; Central of New Jersey; Chicago, Burlington & Quincy; Chicago & Northwestern; Chicago, Milwaukee & St. Paul; Cincinnati, New Orleans & Texas Pacific; Delaware, Lackawanna & Western; Great Northern; Illinois Central; Louisville & Nashville; Northern Pacific; Pennsylvania; Pere Marquette, and Southern.

Preliminary installations are in operation or have been completed by the Boston & Albany; Boston & Maine; Chicago & Alton; Chicago, Indianapolis & Louisville; Delaware & Hudson; Kansas City Southern; Lehigh Valley; Michigan Central; New York Central; New York, Chicago & St. Louis; Pennsylvania; Pittsburgh & Lake Erie, and Richmond, Fredericksburg & Potomac.

Preliminary installations are under construction on the Cleveland, Cincinnati, Chicago & St. Louis; Erie, and Long Island.

The three roads that have selected the ramp type are the Chesapeake & Ohio (American); Chicago & Eastern Illinois (Miller), and Chicago, Rock Island & Pacific (Regan).

The twenty-three that have selected the intermittent induction type are the Atlantic Coast Line; Boston & Albany; Cincinnati, New Orleans & Texas Pacific; Cleveland, Cincinnati, Chicago & St. Louis; Delaware & Hudson; Erie; Kansas City Southern; Lehigh Valley; Michigan Central; New York Central; Pere Marquette, and Southern, of the type of the General Railway Signal Company; the Chicago & Alton; Galveston, Harrisburg & San Antonio; Missouri Pacific; St. Louis-San Francisco, and Southern Pacific, of the type of the National Safety Appliance Company; the Chicago, Burlington & Quincy; Chicago, Indianapolis & Louisville; Great Northern, and Northern Pacific, of the type of the Sprague Safety Control and Signal Corporation; and the New York, Chicago & St. Louis, and the Pittsburgh & Lake Erie, of the type of the Union Switch & Signal Company.

The thirteen that have selected the continuous induction type are the Chicago & Northwestern and Baltimore & Ohio (General Railway Signal Company), and the Boston & Maine; Delaware, Lackawanna & Western; Long Island; Louisville & Nashville; Oregon-Washington Railroad & Navigation Company; Richmond, Fredericksburg & Potomac; Union Pacific; Atchison, Topeka & Santa Fe; Norfolk, Western, and Reading (Union Switch & Signal Company).

The six that have selected plain automatic stop are the Chicago, Milwaukee & St. Paul; Illinois Central; New York, New Haven & Hartford; Pennsylvania; Pittsburgh, Cincinnati, Chicago & St. Louis; and West Jersey & Seashore (Union Switch & Signal Company).

Meetings and Conventions

Steel Treaters convention at Cleveland

The seventh annual convention and exposition of the American Society for Steel Treating was held at Cleveland, Ohio, September 14 to 18 inclusive, and in attendance and in size of exhibition undoubtedly surpassed any convention yet held by the Society. While official attendance figures are not yet available it is understood that the total registration, including guests, was in the neigh-

Freight cars installed and retired

Month—1925	Installed during month	Aggregate capacity tons	Retired during month	Aggregate capacity tons	Owned at end of month	Aggregate capacity tons
January	11,768	551,263	7,867	326,812	2,341,109	103,812,974
February	15,024	721,867	9,453	365,111	2,346,687	104,169,525
March	16,007	753,947	12,067	474,644	2,350,697	104,454,128
April	13,749	652,462	10,497	423,322	2,353,956	104,683,798
May	12,982	612,607	8,658	335,401	2,356,641	104,902,235
June	12,191	590,657	9,797	365,589	2,359,040	105,127,861
Total for 6 months	81,721	.....	.....	.....	.....	.....

Figures prepared by Car Service Division A. R. A.

Freight car repair situation

1925	Number freight cars on line	Cars awaiting repairs: Heavy	Light	Total	Per cent of cars awaiting repairs
January 1	2,293,487	143,962	47,017	190,979	8.3
February 1	2,305,520	139,056	47,483	186,539	8.1
March 1	2,313,092	141,192	43,855	185,047	8.0
April 1	2,315,732	143,329	43,088	186,417	8.1
May 1	2,316,561	144,047	45,467	189,514	8.2
June 1	2,320,261	146,998	48,988	195,986	8.4
July 1	2,326,734	150,530	47,938	198,468	8.5
August 1	2,335,223	153,674	43,607	197,281	8.4

Data from Car Service Division reports.

Month	Cars repaired: Heavy	Light	Total
December	66,615	1,288,635	1,355,250
January, 1925	69,084	1,358,308	1,427,392
February	66,283	1,313,088	1,379,371
March	71,072	1,348,078	1,419,150
April	69,631	1,290,943	1,360,574
May	65,651	1,276,826	1,342,477
June	71,789	1,296,558	1,368,347
July	70,087	1,330,595	1,401,682

borhood of 3,500. There were 180 exhibitors of machine tools and steel treating and testing equipment, and a great number of the exhibits were in actual operation. The technical sessions were well attended and the appreciation of the many excellent papers presented was indicated by the discussion which followed. Among the subjects covered were tool steels, carburizing, welding and tool tempering and hardness testing.

The following officers were nominated: President, R. M. Bird, Philadelphia; vice-president, J. F. Harper, Milwaukee, Wis.; directors, R. G. Guthrie, Chicago, and H. Bornstein, Moline, Ill. Chicago was selected for the 1926 convention.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

AMERICAN RAILWAY ASSOCIATION, DIVISION V.—MECHANICAL—V. R. Hawthorne, 431 South Dearborn St., Chicago.
DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.
DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet Ave., Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Regional meeting October 5-7, at Altoona, Pa. Technical program on transportation problems. Railroad Division. A. F. Steubing, Bradford Corp., 25 West Forty-third St., New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrencetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual meeting, October 27 to 30, inclusive, Hotel Sherman, Chicago.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charron St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—R. E. Giger, 721 North 23rd St., E. St. Louis, Ill. Meetings, first Tuesday in month, except June, July and August, at the American Hotel Annex, St. Louis.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club building, Los Angeles, Cal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Regular meetings, second Thursday each month, Hotel Statler, Buffalo, N. Y. Next meeting October 15. A paper on Supplies—Their Distribution and Cost will be presented. Moving pictures of N. Y. C. scrap yard at Cleveland.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—A. S. Sternberg, Belt Railway, Clearing Station, Chicago.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings, second Tuesday, February, May, September and November.

CLEVELAND STEAM RAILWAY CLUB.—F. D. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meeting first Monday each month except July, August and September, at Hotel Cleveland, Public Square, Cleveland.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. B. Hutchinson, 1809 Capitol Ave., Omaha, Neb. Next meeting May 11-14, 1926, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York, N. Y.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in month, except June, July, August and September. Copley-Plaza Hotel, Boston, Mass. Next meeting October 13. A paper will be read by J. H. Hustis, president, Boston & Maine.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meeting third Friday each month, except June, July and August, at 29 West Thirty-ninth St., New York. Next meeting October 16. Younger men's night.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgreb, 625 Brisbane Building, Buffalo, N. Y. Regular meetings, January, March, May, September and October.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

RAILWAY CLUB OF GREENVILLE.—F. D. Castor, clerk, maintenance of way department, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHEASTERN CARMEN'S INTERCHANGE ASSOCIATION.—J. E. Rubley, Southern Railway shops, Atlanta, Ga.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 189 West Madison St., Chicago. Regular meetings, third Monday in each month, except June, July and August.

Supply Trade Notes

The National Lock Washer Company has moved its Chicago offices from 1535 Lytton building to 1103 Straus building.

G. P. Donelson, formerly president of the Continental Bolt & Iron Works, Chicago, died in California on September 3.

The General American Tank Car Corporation has acquired the plant of the Lone Star Tank Company of Fort Worth, Tex., and Wichita Falls.

John H. Ohlsson, assistant general manager of sales of the J. G. Brill Company, died suddenly on September 3, at his home in Philadelphia, Pa.

The Independent Pneumatic Tool Company, Chicago, has opened a branch office at 288 East Water street, Milwaukee, Wis., in charge of G. H. DuSell.

G. H. Woodroffe has been appointed metallurgical engineer, a newly created position, of the Reading Iron Company's boiler tube department at Reading, Pa.

The Marlin-Rockwell Corporation, New York, manufacturers of ball bearings, has purchased the plant of the Strom Ball Bearing Manufacturing Company, Chicago.

John J. Hannahan, assistant to the president of the Locomotive Stoker Company, Pittsburgh, Pa., died at his home in Merriam Park, Minn., on September 4, after a brief illness.

Stephen F. Sullivan, vice-president of the Ewald Iron Company, with headquarters in Chicago, died in Benton Harbor, Mich., on September 6, after a short illness of heart trouble.

E. J. Bartlett, general manager of the Baker R & L Company, Cleveland, Ohio, has been elected president, to succeed F. W. Treadway, who has been made chairman of the board of directors.

L. M. Zimmer has been appointed general sales manager of the Linde Air Products Company, manufacturers of oxygen, and of the welding gas division of the Prest-O-Lite Company, Inc., manufacturers of dissolved acetylene, succeeding L. M. Moyer, resigned.

Victor W. Ellet has been appointed sales manager of the Hunt-Spiller Manufacturing Corporation, with headquarters at Boston, Mass., in succession to John G. Platt, whose jurisdiction as vice-president has been extended to cover operation as well as sales.

Milburn Moore, eastern engineering editor of the Railway Age and Railway Engineering and Maintenance, has resigned to become associated with the Verona Tool Works, Pittsburgh, Pa., as district sales manager, with headquarters at 50 Church street, New York.

The Independent Pneumatic Tool Company, manufacturers of Thor pneumatic tools and electric tools, has opened a branch office at Milwaukee, Wis., in charge of G. H. Du Sell, who has represented the company in this territory for a number of years. The new office will be located at 288 East Water street.

The Hulson Grate Company, Inc., Keokuk, Iowa, which bought the Pechstein Iron Works, in Keokuk, last April, has recently placed the plant in operation. The machine and boiler shops have been discontinued and the foundry has been re-equipped and modern machinery installed for the manufacture of Hulson grates.

Joseph V. Miller, western sales representative of the Prime Manufacturing Company, Milwaukee, Wis., has resigned to go to the Chicago, Milwaukee & St. Paul as assistant general storekeeper. C. Arthur Dunn, eastern sales representative of the Prime Manufacturing Company, with headquarters at Philadelphia, has been promoted to sales manager, railway division, with headquarters at Milwaukee.

The Locomotive Terminal Improvement Company, Chicago, has taken over the manufacturing department of the National Boiler Washing Company, Chicago. This includes the manufacture of leadized pipes, leadized boiler tubes for both locomotive and stationary use, post and pillar cranes, and other locomotive terminal facilities. Officers of the Locomotive Terminal Improvement Company are: President, Spencer Otis, president of the National Boiler

Washing Company; secretary and treasurer, John S. Maurer, vice-president and treasurer of the National Boiler Washing Company; chief engineer, F. S. Wichman, chief engineer of the National Boiler Washing Company; and sales engineer, W. J. Wignall, of the engineering and purchasing department of the National Boiler Washing Company.

M. A. Weidmayer, formerly branch manager of the Black & Decker Manufacturing Company, is now in charge of the Philadelphia office of the United States Electrical Tool Company, and C. H. Scaffe, formerly connected with the Black & Decker Manufacturing Company at St. Louis, is now a special representative of the United States Electrical Tool Company, operating from the general office at Cincinnati, Ohio.

The C. H. Hollup Corporation, formerly the International Welding Engineering Corporation, Chicago, manufacturer of welding wire and supplies, has purchased 15,000 sq. ft. of land on South Turner avenue and West 48th Place, upon which it will construct a factory building. The building will have approximately 12,000 sq. ft. of floor space and will be of brick and mill construction with faced brick, terra cotta trimmed on the north and east ends.

L. G. Plant, assistant to the president of the National Boiler Washing Company, Chicago, has resigned to engage in selling and financing locomotive terminal utilities, with offices in the Railway Exchange building, Chicago. He will represent the T. W. Snow Construction Company as general railway sales agent for this company's unit system locomotive coaling station and the Locomotive Terminal Improvement Company as general sales agent for the direct steaming system.

The Dearborn Chemical Company contemplates the construction of a warehouse in Los Angeles, Cal., while the plant under construction in Chicago will be ready for occupancy on October 17. This company has appointed V. Cattoretti & Co., La Paz, Bolivia, its agent for oils and greases in Bolivia. It has also appointed Graham, Rowe & Co., Lima, Peru, its agent for oils and greases. This company has been agent for the Dearborn Chemical Company for its water treatment service and chemicals.

E. H. Wood, former master car builder of the Michigan Central, has joined the sales force of the Grip Nut Company as district sales manager, with headquarters in Chicago. Mr. Wood entered the service of the Canadian Pacific as a car repairer in 1899, and subsequently was successively car inspector, foreman, general foreman and general car foreman until September, 1915, when he resigned. The following month he went to the Michigan Central as inspector at Kensington. He was appointed general car foreman in November of the same year, and assistant master car builder in May, 1919. Mr. Wood was appointed master car builder in May, 1920, and later became passenger car foreman at Chicago, remaining in that service until January of this year.

E. H. Wood

John T. Llewellyn, vice-president of the Chicago Malleable Castings Company and president of the Allied Steel Castings Company, Chicago, has been elected president of the Chicago Malleable Castings Company, to succeed Silas J. Llewellyn, deceased. James S. Llewellyn, secretary of the Chicago Malleable Castings Company, and secretary and works manager of the Allied Steel Castings Company, has been elected vice-president, general manager and secretary of the Chicago Malleable Castings Company, and vice-president, general manager and secretary of the Allied Steel Castings Company. Paul Llewellyn, treasurer of the Chicago Malleable Castings Company and vice-president of the Interstate Iron & Steel Company, has been elected vice-president and treasurer of the Chicago Malleable Castings Company.

John T. Llewellyn was born in Briton Ferry, Wales, and came to America in 1864. He was educated in the public schools of Cleveland, Ohio, and Chicago, and in 1880 he entered the employ of the Illinois Steel Company as a telephone operator. In 1896 he organized the Valve Setting Company, Racine, Wis., and in 1898 he organized the Chicago Malleable Castings Company, of which he has since been vice-president and general manager. James S. Llewellyn was born in 1887 in Milwaukee and was graduated from the University of Michigan in 1908. After leaving school he entered the employ of the Chicago Malleable Castings Company and worked in the shops, occupying several positions until 1915, when he was appointed secretary, which position he has held until his recent promotion. Paul Llewellyn was born in 1886 and was educated at Yale University. In 1908 he entered the employ of the Interstate Iron & Steel Company, since which he has been manager of the East Chicago works, sales manager, vice-president of the latter company and treasurer of the Chicago Malleable Castings Company.

William H. Heulings, Jr., vice-president and general manager of sales of the J. G. Brill Company, Philadelphia, died on September 14 in the Jefferson Hospital, that city, after a brief illness. Mr. Heulings has been identified with the Brill Company since boyhood, starting in February, 1885, as a stenographer. He was transferred to the sales branch of the business at the age of twenty and became assistant secretary of the company in 1901, and in 1903 assumed, in addition, the duties of general manager of sales. In June, 1914, he was elected vice-president and held this joint responsibility at the time of his death. Mr. Heulings was born on November 17, 1869, in Philadelphia, and received his education in the public schools of that city. He was also vice-president and a director of the American Car Company, St. Louis, Mo., and a director of both the G. C. Kuhlman Car Company, Cleveland, and the Wason Manufacturing Company, Springfield, Mass., subsidiaries of the J. G. Brill Co.

W. H. Heulings, Jr.

Control of the Hall-Scott Engine Company, Oakland, Calif., manufacturers of motors for the Fageol Motors Company, has been acquired by the American Car & Foundry Company. The J. G. Brill Company is associated with the American Car & Foundry Company in this purchase. Reports are current that control of the Brill Company is about to pass to new interests. One rumor is to the effect that there is in contemplation the formation of a new company to be controlled by the American Car & Foundry Company or interests associated with the latter. The new company, it is said, will take over control of the Brill Company, the Hall-Scott Engine Company and the Fageol Motors Company, of Ohio. The American Car & Foundry Company has issued the following statement denying these rumors:

Following the announcement that American Car & Foundry Company had purchased a controlling interest in the Hall-Scott Motor Car Company of Berkeley, Cal., it was persistently rumored that it had also acquired certain companies to whom Hall-Scott Company had been supplying gas engines for use in motor trucks, buses, etc. Fageol Motor Company of California, Fageol Motor Company of Ohio and the J. G. Brill Company were mentioned as having been thus acquired. American Car & Foundry Company denies that it has purchased control of these or any other customers of the Hall-Scott Company, and states that the rumors are unfounded.

National Machinery Company exhibits forging machinery

The National Machinery Company held its second annual exhibition and demonstration of forging machinery at its plant, Tiffin, Ohio, August 21 to 26, 1925, inclusive. The first day of the exhibition was set aside as Master Blacksmiths' day, and practically

all those in attendance at the convention of the International Railroad Master Blacksmiths' Association at Cleveland, Ohio, attended. Special arrangements were made for the transportation of the members and other guests between Cleveland and Tiffin.

This exhibition was the second of its kind to be conducted by the National Machinery Company, the first being held fifteen years ago. The entire plant was used for the exhibition of the various machine tools, production work practically ceasing while the exposition was in progress. A total of 62 machines, of which 35 were

Visitors watching a demonstration—62 machines were on exhibition, 35 of which were in operation

in operation, and 10 furnaces were on exhibit. Forging machines ranging from 1 in. to 5 in. capacity, each equipped with the necessary dies and furnaces, were in actual production on forging jobs. A number of continuous automatic feed bolt and rivet headers were also in operation, in which many improvements designed to expedite production have been incorporated. In addition there were on exhibit, bolt heading machines fed by a new type of automatic electric header, semi-automatic bolt heading machines, semi-automatic and automatic nut tappers, automatic thread bolt trimmers, rolled thread bolt machines and a battery of bolt cutters. These

Interior view of the National Machinery Company's plant, Tiffin, Ohio, during the exposition

bolt machines constituted a complete bolt producing plant. Some of the more interesting forging jobs demonstrated to the master blacksmiths the possibilities of the forging machine in railway blacksmith shop work for the production of locomotive cylinder cocks, brake lever fulcrums, side rod nuts, freight car floor bolts, brake hangers, locomotive ash pan levers, handholes or grab irons, and brake chain clevices.

The exhibition also demonstrated the various stages of manufacture of the machines produced by the National Machinery Company and how the various parts functioned when in actual operation.

Trade Publications

Screw, nut and stud drivers.—A 12-page brochure, descriptive of portable electric screw, nut and stud drivers, has been issued by the United States Electrical Tool Company, Cincinnati, Ohio. Charts showing capacities of different models and pilot hole sizes and specifications are also included.

Trucks and tractors.—A 40-page catalogue descriptive of the mechanical features of the various types of Crescent trucks and tractors and showing the purpose for which each type is particularly adapted, has been issued by the Crescent Truck Company, Lebanon, Pa. Specifications and line drawings are also included.

Regulators.—The Alexander Milburn Company, Baltimore, Md., has issued an eight-page brochure descriptive of its standard regulators for oxygen, acetylene and other gases. The rear opening of the Milburn regulator is only 1⅛ in. diameter, which enables the cap to be unscrewed and the seat and nozzle to be immediately reached without undoing any other part.

Vertical turret lathe.—A four-page bulletin showing front and back cylinder head operations on vertical turret lathes having diameters 30½ in., 32 in., 34½ in. and 36 in., respectively, has been issued by the Bullard Machine Tool Company, Bridgeport, Conn. The side head and turret, which provides additional tooling capacity, ample support for heavy cuts and simultaneous cutting facilities, is also described.

"Net profits from small lots."—This is the title of a 16-page booklet issued by the Warner & Swasey Company, Cleveland, Ohio, which shows the way to net profits from small lot production by the use of universal turret lathes with standard tool equipment, making five to fifteen pieces of one kind at a time, thus cutting the time in half as compared to engine lathe methods. Illustrations show comparative facts about keeping the machine busy, set-up time, production and the net profit from the investment.

Pressure regulating devices.—General catalogue No. 62, descriptive of its pressure regulating devices, has been issued by the Mason Regulator Company, Boston, Mass. The catalogue, which contains 178 illustrated pages, is divided into five sections, Section I being devoted to pressure reducing valves; Section II, to automatic regulating devices for pumps and pressure regulators; Section III, to boiler pressure regulators, damper regulators and fan engine regulators; Section IV, to balanced valves, companion flanges, strainers and pilot valves, and Section V, to tables for obtaining sizes of pressure reducing valves, general information for engineers and contractors, and telegraphic code.

Feedwater heaters.—Instructions for the operation and maintenance of the Elesco locomotive feedwater heater are contained in a 74-page handbook recently issued by the Superheater Company, New York. After a brief description of the principle used in its design, the Elesco heater and its parts are described. The succeeding chapters deal with the operation, maintenance, inspection and test of the equipment, how it is cleaned, heater and pump repairs, and questions and answers regarding operation. Charts show in colors the various passages of live and exhaust steam, hot and cold water through a locomotive equipped with the Elesco heater and the passages of steam and water through various parts of the heater itself.

Electrical supplies.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing its new 1925-27 catalogue of electrical supplies. The publication contains 1,200 pages and is profusely illustrated with 4,500 engravings. All new apparatus designed and manufactured in the past two years, as well as all the previous established types are listed. A very complete subject index in the front of the book is printed on blue paper so that it can be quickly located, and a style number index for checking invoices is located in the back of the book. A classified index under such classifications as central stations, electric railways, industrial plants, mines, etc., gives a complete list of apparatus applicable to each of these groups of industries, and the thumb index enables the user to locate any section of the catalogue with the least inconvenience.

Personal Mention

General

F. A. Starr has been appointed supervisor of reclamation of the Chesapeake & Ohio, with headquarters at Richmond, Va.

P. C. Morales has been appointed superintendent of machinery and motive power of the National Railways of Mexico, succeeding S. A. Alzati, resigned.

J. P. Roquemore, superintendent of motive power of the International-Great Northern at Palestine, Tex., has been promoted from mechanical assistant to executive vice-president, with headquarters at Houston, Tex., a newly created position.

S. T. Armstrong, master mechanic of the San Antonio division of the International-Great Northern at San Antonio, Tex., has been promoted to superintendent of motive power, with headquarters at Palestine, Tex., in place of J. P. Roquemore.

Master Mechanics and Road Foremen

O. C. Branch has been appointed road foreman of engines of the North Carolina division of the Seaboard Air Line, with headquarters at Hamlet, N. C.

George B. Riddle has been appointed assistant road foreman of engines of the North Carolina division of the Seaboard Air Line, with headquarters at Hamlet, N. C.

F. R. Butts has been appointed acting master mechanic of the Brookfield division of the Chicago, Burlington & Quincy, with headquarters at Brookfield, Mo., to succeed H. H. Urbach, who has been assigned to other duties.

Ammon Hambleton, whose appointment as master mechanic of the El Paso-Amarillo division of the Chicago, Rock Island & Pacific at Dalhart, Tex., was announced in the August issue of the *Railway Mechanical Engineer*, was born on November 4, 1883, at Aroca, Kans. He graduated from the Atchison, Kans., high school, and in January, 1900, entered the employ of the C. R. I. & P. at Horton, Kans., as a machinist apprentice. In July, 1902, he was transferred to the new Chickasha, Okla., shops, where he completed his apprenticeship in January, 1904. He then served as a machinist until November of the same year, when he was promoted to machine shop foreman. From October, 1906, to January, 1907, he was a machinist at Shawnee, Okla.; from January, 1907, to July, 1910, machine foreman, and from July, 1910, to April, 1914, roundhouse foreman, being transferred on the latter date to Chickasha, as general locomotive foreman. He was transferred to Shawnee as general locomotive foreman in April, 1917, and in April, 1920, appointed master mechanic of the Louisiana division, with headquarters at El Dorado, Ark. In June, 1921, the Louisiana division was consolidated with the Arkansas division under the jurisdiction of the Arkansas division staff, and Mr. Hambleton was transferred back to Shawnee as general foreman, locomotive department, in which position he remained until his appointment as master mechanic of the El Paso-Amarillo division.

A. Hambleton

Car Department

W. P. Pettus, car foreman of the Chicago & Eastern Illinois, at Terre Haute, Ind., has been appointed car foreman of the Gulf Coast Lines, with headquarters at Kingsville, Tex.

G. T. Patton has been appointed car foreman in charge of freight cars of the Baltimore & Ohio, with headquarters at Mt. Clare, Baltimore, Md., succeeding J. F. Ford, resigned.

Shop and Enginehouse

W. K. Gonnerman has been promoted to superintendent of shops of the entire Akron division of the Baltimore & Ohio.

A. E. Spurr has been promoted to assistant enginehouse foreman of the Northern Pacific, with headquarters at St. Paul, Minn.

E. J. Cole, superintendent of shops of the Union Pacific at Cheyenne, Wyo., has been transferred to Omaha, Neb., succeeding J. W. Highleyman.

J. W. Highleyman, acting superintendent of shops of the Union Pacific, has resumed his duties as assistant superintendent of motive power and machinery.

B. F. Hoard, assistant enginehouse foreman of the Northern Pacific at St. Paul, Minn., has been promoted to enginehouse foreman, with headquarters at Jamestown, N. D.

W. C. Rogers has been appointed supervisor of passenger locomotive operations on the South Carolina division of the Seaboard Air Line, with headquarters at Savannah, Ga.

B. Koontz has been appointed supervisor of passenger locomotive operations on the Virginia and North Carolina divisions of the Seaboard Air Line, with headquarters at Raleigh, N. C.

Purchases and Stores

C. L. Tiller has been appointed division storekeeper of the Southern, with headquarters at South Richmond, Va., succeeding W. N. Pollard, deceased.

Obituary

J. H. Daley, mechanical superintendent of the New York, New Haven & Hartford, died in a hospital at Auburn, N. Y., on August 28.

Lehigh Valley Railroad

TO ALL EMPLOYES:

Do you know that a railroad must haul a ton of freight

2254	miles	to cover the cost of setting out, repairing and picking up a car on account of a hot box
2205	"	to cover the cost of replacing a broken drawhead
506	"	to pay one hour's overtime for a train or yard crew
395	"	to buy a ton of fuel coal
90	"	to pay for one foreign car for one day
43	"	to buy a gallon of valve oil?

Are you doing your part to prevent hot boxes, pulled out drawheads, and unnecessary overtime? Will you help us reduce waste? Your co-operation will be welcomed by the management and you will enjoy the satisfaction that goes with a job well done.

General Manager

Poster used on the Lehigh Valley in a campaign to prevent hot boxes